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RIO DE LA PLATA, PUERTO RICO

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

TRANSMITTING

RECOMMENDATIONS OF THE SECRETARY ON A REPORT DATED JANUARY 3, 1989, FROM THE CHIEF OF ENGINEERS, ON RIO DE LA PLATA, PUERTO RICO, TOGETHER WITH OTHER PERTINENT REPORTS AND COMMENTS

MAY 17, 1990.—Referred to the Committee on Public Works and Transportation and ordered to be printed

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

[illegible]

Honorable Thomas S. Foley
Speaker of the House
of Representatives
Washington, D. C. 20515

Dear Mr. Speaker:

I am transmitting the recommendations of the Secretary of the Army on a report dated January 3, 1989, from the Chief of Engineers, Department of the Army, on Rio de la Plata, Puerto Rico, together with other pertinent reports and comments. These reports were prepared in final response to a resolution adopted May 5, 1966, by the Committee on Public Works, U. S. House of Representatives.

The views of the Commonwealth of Puerto Rico, the Departments of the Interior, Transportation, Commerce and the Environmental Protection Agency are set forth in the enclosed communications together with pertinent replies.

The plan recommended for flood control consists of 8.5 miles of channel improvements and 9.8 miles of levee construction. The plan provides for the maximization of net national economic development benefits.

The Secretary recommends authorization of the plan described in the report of the Chief of Engineers at a total cost of $55,915,000, subject to appropriate conditions of non-Federal cooperation including:

- cost-sharing requirements of Public Law 99-662 at a estimated cost of $21,816,000; and
- the project sponsor be required to furnish the items of local cooperation described on pages 7 and 8 of the report of the Board of Engineers for Rivers and Harbors except that all utility relocations are a local responsibility.

Additionally, several new items of local cooperation are recommended in connection with the authorization of the project. These provisions address non-Federal responsibilities for hazardous materials on project lands and encourage responsible management of hazardous materials by ensuring that Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) liability costs do not become a cost of constructing, operating, maintaining, repairing, replacing, or rehabilitating Federal projects. Specifically that:

- any cost incurred with the cleanup of hazardous materials located on project lands and covered under CERCLA shall be considered a non-Federal responsibility for which no cost sharing credit be given;
- the project sponsor shall be required to operate, maintain, repair, replace, and rehabilitate the project in a manner so that liability will not arise under CERCLA.

The Office of Management and Budget advises that the recommendation is consistent with the program of the President and there is no objection to the submission of this report to Congress. A copy of its letter is enclosed in the report.

Sincerely,

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

Enclosure

G. Edward Dickey
Acting Principal Deputy Assistant Secretary
(Civil Works)

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

March 19, 1990

Honorable Robert W. Page, Sr.
Assistant Secretary of
the Army (Civil Works)
Room 2E570 - Pentagon
Washington, D.C. 20319-0103

Dear Mr. Page:

As required by Executive Order 12322, we have completed our review of your recommendation for the report on Rio de la Plata, Puerto Rico, enclosed with your letter of September 12, 1989.

The Office of Management and Budget would not object to your submitting this report to Congress. Your recommendation is consistant with the program of the President, contingent upon project authorization and funding in accordance with cost-sharing provisions of P.L. 99-662.

Sincerely,

for David M. Gibbons
Deputy Associate Director
for Natural Resources

COMMENTS OF THE COMMONWEALTH OF PUERTO RICO

COMMONWEALTH OF PUERTO RICO
OFFICE OF THE GOVERNOR
PUERTO RICO PLANNING BOARD

Minillas Governmental Center, North Bldg.
De Diego Ave., Stop 22
P.O. Box 41119, San Juan, P.R. 00940 - 9985

August 25, 1988

Mr. John M. McCann
Acting Resident Member
Evaluation Division
Department of the Army
Fort Belvoir, Virginia 22060-5576

Dear Mr. McCann:

We have reviewed the current COE report on the La Plata River, finding the discussion of lands of importance to agriculture adecuate. We request, however, that alternate disposal areas be identified at later stages. The area now proposed for the disposal of dredged material is necessary for urban development.

If further geological studies reveal the dredged material is unsuitable for urban development and would have to be removed, please feel free to contact us so that we may identify alternate sites.

It is important that the areas identified in this document for urban development be conserved as viable options for accommodating in a compact and adequate manner, the expected population growth for this region without the need to utilize the prime agricultural lands between La Plata River and Levittown.

Sincerely,

Patria G. Custodio
Chairperson

COMMENTS OF THE DEPARTMENT OF THE INTERIOR

United States Department of the Interior
OFFICE OF ENVIRONMENTAL PROJECT REVIEW
WASHINGTON, D.C. 20240

SEP 12 1988

ER 88/481

Lieutenant General H. J. Hatch
Chief of Engineers
ATTN: CECW-PM
Department of the Army
Washington, D.C. 20314-1000

Dear General Hatch:

The Department of the Interior has completed its review of your proposed report, other pertinent reports, and final environmental impact statement for Rio de la Plata, Puerto Rico. We have the following comments and recommendations.

Chiefs Report and Other Pertinent Reports

Our Fish and Wildlife Service (FWS) has worked closely with the Corps throughout the planning phases of this project. During the planning process, FWS reviewed and provided comments dated February 11, 1987, on the Corps' Draft Feasibility Report. Subsequent to these comments, the Corps significantly modified the locations of two dredged material disposal areas without further coordination with the FWS.

As presently designed the two disposal areas could significantly alter wetland habitat in the project area. A preliminary field analysis indicated that disposal of dredged material under the Corps' preferred alternative would eliminate important wetland habitat and that less damaging, upland disposal areas were available in the project area. Roughly two-thirds of Disposal Area 1 identified in the final reports is located in semi-permanently flooded wetland habitat. Disposal Area 2 is located in a deeper and more continuous expanse of wetlands dominated by freshwater wetland vegetation. The wetland habitat values for wildlife have not been identified since this modification to the proposed project was not coordinated with FWS. However, herons and egrets were observed in the marsh, and a lagoon within the marsh at Disposal Area 2 may provide important waterfowl habitat.

The proposed Chief of Engineers report notes that the Corps proposes to replace approximately 5 acres of mangroves that would be eliminated by construction of levee west of the river's mouth. The mangrove forest on that side of the river mouth measures about 25 acres, and the estimated loss of 5 acres represents the minimum project impact provided that the contractor exercises caution to preserve the remaining 20 acres of mangrove forest. These reports and the environmental statement should contain a thorough discussion of the measures to mitigate wetland losses including the preservation of the remaining 20 acres of mangrove forest. The proposed freshwater inflow to the Rio Cocal wetlands should also be discussed.

The possibility of liquefaction of water-saturated sands or sandy sediments should be considered in preconstruction planning of all potentially susceptible structures. Additionally, karstic hazards over carbonate terrane should be addressed.

The data attributed to our U.S. Geological Survey in Tables A-1 and A-4 should be rounded to three significant figures to avoid implying an accuracy that exceeds the original data.

In summary, the Chief of Engineer's recommended plan does not adequately incorporate previous FWS recommendations and the plan has not received adequate review.

Final Environmental Impact Statement

Mineral resources, as described in the final environmental statement, would be impacted by the increased use of rock from local quarries for riprap, gabion construction, and concrete aggregate. Local producers should benefit from this action. The final environmental statement also mentions that numerous active and inactive sand and gravel pits exist along the La Plata River near the town of Toa Alta, but it does not discuss possible adverse impacts that the proposed project may have on them. For completeness, we believe that a discussion of possible adverse impacts to the sand and gravel resources should be identified and possible mitigating measures discussed.

Because of the changes in location of the two dredged material disposal sites without further agency coordination, we recommend that a supplemental impact statement be prepared and circulated to the agencies and the public.

Thank you for the opportunity to comment on these documents.

Sincerely,

Bruce Blanchard, Director

LETTER TO THE DEPARTMENT OF THE INTERIOR

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON D.C. 20314-1000

REPLY TO
ATTENTION OF

CECW-PE

3 JAN 1989

Mr. Bruce Blanchard
Director
Office of Environmental Project Review
U.S. Department of Interior
Washington, D. C. 20240

Dear Mr. Blanchard:

This is in response to your letter of September 12, 1988, regarding the Final Environmental Impact Statement (FEIS) for the Rio de la Plata, Puerto Rico flood control project.

One of your major concerns was the disposal of excavated and dredged material in disposal areas 1 and 2. These locations had been previously coordinated with the Fish and Wildlife Service in the draft environmental impact statement. We continue to assess the value of these wetlands as less than important habitat. However, our recent reevaluation indicates that practical alternatives to wetland disposal do exist. Sites approximately 800 meters west of disposal area 1 and approximately 1200 meters south of disposal area 2 have been identified. Field inspections indicate that these upland areas are presently used for pasture and agriculture and are of limited wildlife habitat quality. These new disposal areas have been coordinated with U.S. Fish and Wildlife Service field staff.

Culverts are proposed to provide water from the Rio de la Plata to the Rio Cocal. The relationship between the hydrology of Rio Cocal and Rio de la Plata has not been determined sufficiently to develop criteria for the regulation and design of the proposed structures. The appropriate design and operating criteria for the water control structures will be addressed during the planning, engineering, and design (PED) phase of this project.

Every effort will be made to avoid damage to mangroves at the mouth of the Rio de la Plata, and our assessment indicates that only 5 acres will be adversely affected. Detailed plans for the mitigation of these 5 acres will be developed during the PED phase. This mitigation will be in-kind and adjacent to the disturbed area. Five acres of floodplain, in hydrologic connection with the river, will be lowered to a proper intertidal elevation and planted with mangroves. Our preliminary analysis indicates that soil and salinity factors are satisfactory, there will be adequate protection from wave and current energy, and the site will be flushed daily. This is an ideal situation for mangrove establishment and we expect rapid development of a fully functional wetland.

This project will not have adverse impacts on local active or inactive sand and gravel resources.

Sincerely,

H. J. Hatch
Lieutenant General, U. S. Army
Commanding

COMMENTS OF THE DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

January 24, 1989

Lieutenant General H. J. Hatch
Chief of Engineers
ATTN: CECW-P
Department of the Army
Washington, D.C. 20314-1000

Dear General Hatch:

It has come to our attention that we did not receive the letter dated June 3, 1988 from John M. McCann, Jr., Acting Resident Member, Board of Engineers for Rivers and Harbors, requesting our review and comment on the proposed report of the Chief of Engineers on Rio de la Plata, Puerto Rico. We did receive a copy of his letter after completion of the 90-day review period and are now providing comments to you as agreed to by our staffs.

The proposed report recommends that the plan of improvement for flood damage reduction along the Rio de la Plata be authorized for implementation as a federal project. The recommended plan (Plan E, Revised) consists primarily of 8.5 miles of channel widening and straightening; 9.8 miles of levees; relocation of bridges, utilities, buildings, and structures (58 residential and 47 nonresidential); and in-kind replacement of 5 acres of mangrove.

The recommended plan is the National Economic Development plan and would eliminate approximately 99 percent of the average annual damages from flooding by the Rio de la Plata. Based on October 1987 price levels, the estimated first cost of the recommended plan is $54,024,000 with a federal share of $32,989,000 and a non-federal share of $21,035,000. Average annual benefits and costs are estimated at $9,755,000 and $5,823,000, respectively. The benefit-cost ratio is 1.7.

We have no objection to the report of the Chief of Engineers and believe the recommended plan would be beneficial to the community.

We do have three concerns. First, we are concerned with whether local zoning procedures are strong enough to ensure preservation of the prime farmlands in the study area for the life of the project. Development pressures will be very strong after construction of the project since "the study area is becoming one of the fastest growing urbanized areas in Puerto Rico; . . ."

Second, we believe that a more intensive cultural resource survey should be undertaken before initiation of construction. A more detailed survey seems justified since the initial survey, which was preliminary and had a limited sample, still identified a significant number of cultural sites in the project area.

Third, while the report adequately addresses solutions in the flooded areas, little attention is given to the source of the flooding problem. The steep upland areas of the basin are in poor hydrologic condition resulting in excessive runoff. Also, soil erosion is occurring. The upstream land use management and total watershed hydrologic condition should be addressed in this study or with other reports under Soil Conservation Service administration.

We also suggest using permanent vegetation of grass and trees as much as possible to enhance the environment and aesthetics of the proposed structural measures. This not only will reduce soil erosion but will provide environmental quality benefits to the people.

As this project is implemented, we would appreciate your district office maintaining communications on these concerns with Humberto Hernandez, Director of the Caribbean Area for the Soil Conservation Service in San Juan, Puerto Rico, telephone number (809-753-4206).

Sincerely,

Peter Myers

PETER C. MYERS
Acting Secretary

COMMENTS OF THE DEPARTMENT OF COMMERCE

UNITED STATES DEPARTMENT OF COMMERCE
The Chief Scientist
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

August 26, 1988

Colonel Pat M. Stevens IV
Chief of Staff
Department of the Army
U.S. Army Corps of Engineers
Washington, D.C. 20314-1000

Dear Colonel Stevens:

This is in reference to your Final Environmental Impact Statement on the Rio de la Plata, Puerto Rico, project. Enclosed are comments from the National Oceanic and Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

David Cottingham

David Cottingham
Ecology and Environmental
Conservation Office

Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

August 4, 1988 F/SER113:SD

Colonel Pat M. Stevens IV
Chief of Staff
Department of the Army
U.S. Army Corps of Engineers
Washington, D.C. 20314-1000

Dear Colonel Stevens:

The National Marine Fisheries Service has reviewed the Final Environmental Impact Statement on the Rio de la Plata, Puerto Rico, project which was submitted to us by undated cover letter and received on July 8, 1988. We offer the following comments pertaining to the project's impacts on fishery resources.

With the exception of the No-Action alternative, all project plans would result in the loss of at least five acres of mangroves near the mouth of the river. Mangroves are a crucial component of the ecosystem and support a variety of commercially and recreationally valuable species. They provide habitat, nursery area, detritus, and water filtration. Unavoidable losses of these mangroves must be adequately mitigated to avoid or minimize adverse impacts to fishery resources.

The project plans call for planting five acres of mangroves on the opposite side of the river. No details for methods or monitoring are provided. We generally recommend that mangrove wetlands be created by scraping down uplands as opposed to simply altering another type of wetland (e.g., mudflats or high marsh). Due to the lag time between the removal of mangroves and establishment of a fully productive mangrove and the probability of less than 100 percent survival, we recommend that impacted vegetation be compensated on a 1.5 for 1.0 basis.

The created mangrove forest should be monitored for at least one year and the area replanted if a minimum 70 percent survival is not achieved. In the interest of minimizing the net loss of production resulting from the removal of mangroves, we recommend these mitigation guidelines be incorporated into the project plans.

Thank you for the opportunity to comment on this FEIS.

Sincerely yours,

Andreas Mager, Jr.
Acting Regional Director
Habitat Conservation Division

COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

US Department
of Transportation
**United States
Coast Guard**

Commandant
United States Coast Guard

Washington D C 20593-0001
Staff Symbol (G-MP-1)
Phone (202) 267-0389

21/3200J
10 JUN 1993

Chief of Engineers
ATTN: CECW-P
Department of the Army
Washington, D.C. 20314-1000

Dear Sir:

We have reviewed the proposed report of the Chief of Engineers, other pertinent reports and Final Environmental Impact Statement on Rio de la Plata, Puerto Rico. We have no comments to offer.

Thank you for giving us the opportunity to review the reports and FEIS on Rio de la Plata.

Sincerely,

M. J. SCHIRO
Captain, U. S. Coast Guard
Chief, Planning Staff
By direction of the Commandant

COMMENTS OF THE ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

AUG 19 1988

Lieutenant General H.J. Hatch
Chief of Engineers
ATTN: CECW-P
Department of the Army
Washington, D.C. 20314-1000

Dear General Hatch:

The Environmental Protection Agency (EPA) has reviewed the Army Corps of Engineers' (ACE) final environmental impact statement (EIS) for the Rio de la Plata flood control project in Puerto Rico. This review was conducted in accordance with Section 309 of the Clean Air Act, as amended (P.L. 91-604 §12(a), 42 U.S.C. §7609) (CAA) and the National Environmental Policy Act (P.L. 91-190, 42 U.S.C. §4321-4347) (NEPA). Based on our review of the final EIS, EPA believes that the project, as proposed, is unsatisfactory from the standpoint of environmental quality.

The project proposed in the final EIS is intended to reduce annual damages resulting from flooding of the Rio de la Plata, Puerto Rico. Major project components include: 8.5 miles of channel improvements (i.e., widening and straightening) and 9.8 miles of levees. Materials excavated for the channel improvements would be used to construct the levees. Excess dredged material would be placed in two disposal areas, totaling 145 acres, south of the Town of Dorado. The proposed project also calls for the construction of four ponding areas, totaling 695 acres. Additionally, the project would enchance approximately 1238 acres of floodplain for future urban development. The estimated cost of the proposed project is $54,024,000 (October 1987 dollars), with a federal share of 32,989,000 and a local share of $21,035,000; the benefit-cost (B-C) ratio is 1.7.

On February 9, 1987, EPA submitted its comments on the draft EIS for the project to the ACE-Jacksonville District. The comment letter rated the draft EIS as EO-2, indicating EPA had environmental objections to the project and that additional information was needed to address our objections. EPA's objections to the project concerned its impacts on water quality, groundwater, wetlands associated with Rio Cocal and Cienaga de San Pedro, and secondary impacts. The final EIS is essentially unresponsive to EPA's comments (see enclosure), but more important, the final EIS presents new information that indicates that the proposed project's adverse impacts on wetlands will be exacerbated. Additionally, the final EIS is deficient in assessing these impacts and presents no discussion of alternatives or mitigation measures that would act to minimize adverse wetland impacts.

The draft EIS for the Rio de la Plata flood control project described the proposed disposal sites for excess dredged material as upland areas. The new description of these same sites in the final EIS, however, is palustrine, emergent, semi-permanent to permanent wetlands. Additionally, the draft EIS did not specify locations for the proposed ponding areas or the proposed developable areas. These areas have now been located and are described in the final EIS as natural pasture/intermitent wetlands. EPA views this new information as a significant change in the project's environmental impacts necessitating the preparation of a supplemental EIS in accordance with 40 CFR 1502.9(c).

The final EIS fails to delineate or describe the wetlands in question, but it implies that up to 1690 acres of wetlands (i.e., 145 acres for disposal sites, 695 acres for ponding areas, and 850 acres for developable areas) could be impacted or lost as a result of the proposed project. On August 15, 1983, EPA conducted an inspection of the project area and determined that 100% of the disposal sites, and approximately 60% and 40% of the ponding and developable areas, respectively, are wetlands of moderate to high quality. In order to verify the total extent of wetlands impacted by the project, the ACE must determine the exact areal extent of wetlands in the disposal sites and ponding and developable areas. The delineation effort must also include an analysis of all the quantitative functional values of the impacted wetlands (i.e., habitat value, floodwater retention, pollutant attenuation, etc.). This should be done on an incremental basis to allow for ready comparison with proposed mitigation measures.

EPA understands that this project may be subject to Section 404(r) of the Clean Water Act, as amended (P.L. 95-95, 33 U.S.C. §466 et.seq.) (CWA). As such, it would be exempted from the formal permitting requirements for the discharge of dredge or fill materials into waters of the United States. However, in order to obtain the 404(r) exemption, the ACE must perform an analysis of the effects of the discharge of dredged or fill material associated with the project that is equivalent to that provided under the 404(b)(1) guidelines. EPA has determined that the 404(b)(1) evaluation presented in the final EIS is seriously deficient.

With respect to the specific project components in question (i.e., the disposal sites and ponding areas), the deficiencies in the project's 404(b)(1) evaluation include an inadequate analysis of practicable alternatives and the lack of a discussion of appropriate mitigation measures. EPA has determined that the use of the disposal sites for excess dredged material and the construction of the ponding areas do not constitute water dependent uses under Section 404 of the CWA. Accordingly, as a first step towards compliance with the 404(b)(1) guidelines, the ACE must establish that there are no practicable alternatives which would have less of an impact on aquatic ecosystems. Neither the 404(b)(1) evaluation nor the final EIS present a discussion of practicable alternatives for these project components.

Further, assuming a proper alternatives analysis was conducted and it established that the proposed locations for the disposal sites and ponding areas were the only practicable alternatives, both the 404(b)(1) guidelines and NEPA mandate the development and implementation of appropriate mitigation measures to minimize adverse environmental impacts. As a matter of policy, EPA requires at least 1:1 value replacement to mitigate for wetlands losses. Again, neither the 404(b)(1) evaluation nor the final EIS present a discussion of mitigation measures for the wetlands losses associated with the disposal sites and ponding areas. EPA expects that the cost of appropriate mitigation (i.e., restoration of up to 600 acres of wetlands) would have a serious adverse impact on the economic feasibility of the proposed project.

In a related matter, the final EIS presents no 404(b)(1) evaluation for the developable areas. Accordingly, EPA assumes that they are not included in the 404(r) exemption being sought for the project. Rather, the filling of wetlands in the developable areas will be subject to formal 404 permitting requirements; the ACE confirmed this during a meeting held on August 3, 1988. With this in mind, however, EPA questions the ACE's inclusion of induced development in these areas as location benefits of the project. The speculative nature of this development serves to exacerbate the uncertainity of the ACE's justification. We believe that benefits of induced development should be eliminated, thereby lowering the B-C ratio of this alternative to 1.2, which is lower than the B-C ratio for EPA's preferred alternative (i.e., Alternative F).

Based on the above, EPA has determined that the Rio de la Plata flood control project, as proposed, is not consistent or otherwise in compliance with the Section 404(b)(1) guidelines of the CWA. Additionally, EPA believes that the proposed project does not comply with Executive Order 11990 ("Protection of Wetlands") because it does not minimize the destruction, loss, or degradation of wetlands, and it does not avoid direct or indirect support of new construction in wetlands wherever there are practicable alternatives.

In summary, based on our review of the final EIS, EPA believes that the Rio de la Plata flood control project, as proposed, is unsatisfactory from the standpoint of environmental quality. Additionally, EPA believes that the final EIS does not fulfill the intent of NEPA or the Council on Environmental Quality (CEQ) regulations (40 CFR Part 1500), and that it is inadequate and unresponsive for the purposes of review under Section 309 of the CAA. Further, EPA is concerned about the ACE's apparent disregard for the compliance requirements of the CWA and Executive Order 11990. Because of the significance of our concerns, EPA believes that addressing them will necessitate major revisions that will affect the feasibility of the proposed project. Accordingly, EPA requests that the ACE prepare a supplemental final EIS to address our concerns.

Recent meetings between EPA and ACE have not resolved our concerns. Accordingly, I am prepared to recommend to the EPA Administrator that this project be referred to CEQ pursuant to 40 CFR Part 1504 for resolution of our outstanding concerns. However, I understand that the ACE is willing to grant an additional 45-day extension of the referral period to allow for resolution of EPA's concerns about the project. EPA would be amenable to the additional extension.

Should you have any questions concerning our review of the final EIS for the Rio de la Plata flood control project, please contact me at (212) 264-2525, or have your staff contact Robert Hargrove, Chief, Federal Activities Section, at (212) 264-6723.

Sincerely,

William J. Muszynski, P.E.
Acting Regional Administrator

Enclosure

cc: D. Bear, CEQ
Colonel R.L. Herndon, ACE - Jacksonville District

ENCLOSURE

Responsiveness of the Final EIS for the Rio de la Plata Flood Control Project to EPA's Objections to the Draft EIS

In our review of the draft EIS, EPA raised objections concerning the project's impacts on water quality, groundwater, wetlands associated with Rio Cocal and Cienaga de San Pedro, and secondary impacts. The following is an analysis of the responsiveness of the final EIS to our objections.

- For the most part, our concerns regarding water quality and groundwater impacts have been addressed. However, in our comments, we expressed concern that the project would diminish water flow into the Rio Cocal and would, therefore, adversely impact the Rio Cocal mangroves and the Cienaga de San Pedro wetlands. Accordingly, EPA requested the addition of a flood control structure to ensure the maintenance of these important wetlands. Although this has been addressed, the final EIS does not present the operational details for the structure, so EPA cannot be sure about its effectiveness.
- EPA's concerns about possible toxic contaminants in the dredged material and their potential impacts to ground and surface water have not been addressed.
- With respect to wetlands impacts, the final EIS has addressed some of our original concerns, but the revised information concerning possible wetland impacts has tended to negate these issues.
- Finally, we had raised objections to the draft EIS because it did not adequately discuss secondary impacts and did not discuss additional infrastructure that would be needed to support the project's induced development. The final EIS merely acknowledges the possibility of secondary impacts and the need for additional infrastructure; this is not sufficient.

Based on the above, EPA considers the final EIS to be unresponsive to our objections on the draft EIS.

LETTER TO THE ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF

CECW-PE

15 NOV 1988

Mr. William J. Muszynski
Acting Regional Administrator, Region II
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Muszynski:

This is in response to your letter of August 19, 1988, regarding environmental aspects of the Survey Report and Environmental Impact Statement (EIS) for the Rio de la Plata, Puerto Rico, flood control project. These issues were discussed at meetings of our staffs on August 3, 1988, and September 16, 1988.

Your concerns included: disposal of dredged material in wetlands; use of wetlands as ponding areas; provision of water to Rio Cocal; possible contaminants in dredged material; the conversion of wetland areas and associated secondary impacts; and infrastructure requirements. You also addressed Section 404(r) exemption and mitigation of wetland losses. Most of these issues are discussed in the final EIS, and I am providing additional clarification below.

Concerning the disposal of excavated and dredged material on 145 acres of wetlands, we continue to assess the value of these wetlands as less than moderate to high quality. However, our recent reevaluation of this issue indicates that practical alternatives to wetland disposal do exist. Sites approximately 800 meters west of Disposal Area 1 and approximately 1200 meters south of Disposal Area 2 have been identified as shown on the attached map. Field inspections indicate that these are upland areas presently used for pasture and agriculture of limited wildlife habitat quality. These areas are part of those described generally by the U.S. Fish and Wildlife Service as greatly modified by man and grazed by dairy cattle. To further minimize impacts, we will examine the possibility of reducing the amount of material disposed by incorporating more of it into the levee system and employing beneficial use alternatives. There may, for example, be a local market for the sand and gravel component of this material. The information necessary for such determinations must await the more detailed data collection and analysis which accompanies the planning, engineering, and design (PED) phase of project development. Likewise, possible uses of excavated material would affect the total area needed for disposal, ranging from 145 acres, if no material is usable, to zero if all material can be used.

LETTER TO THE ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF
CECW-PE

3 JAN 1989

Mr. William J. Muszynski
Acting Regional Administrator, Region II
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Muszynski:

This is my final reply to your letter of August 19, 1988, regarding the Survey Report and Environmental Impact Statement for the Rio de la Plata, Puerto Rico flood control project.

I believe that your major concerns have been addressed by cooperative meetings of our staffs on 3 August 1988 and 16 September 1988, and the interim reply of Brigadier General Patrick J. Kelly, Director of Civil Works, by letter dated November 15, 1988, copy enclosed. I appreciate your comments on this project and your cooperation in resolving the concerns.

Sincerely,

H. J. Hatch
Lieutenant General, U. S. Army
Commanding

1 Encl
as

Our analysis indicates that almost all of the ponding areas are palustrine emergent wetlands. These areas are mostly pasture, interlaced with active row crop farming, historic river course meander scars, and natural and man-made drainageways. Approximately 2% is open water, and about one-third is semipermanently to seasonally flooded. Dominant vegetation on the areas are Typha domingensis, Thalia geniculata, Fimbristylis spp. and Alocasia spp. The remaining two-thirds are temporarily to intermittently flooded. Dominant vegetation on these areas are Paspalum fasciculatum and P. millegrana. The originally designated disposal sites were located in the largely semipermanently flooded area, and will now be incorporated into the ponding feature of the project.

Virtually all of the wetlands are grazed by cattle. The wetter areas are normally isolated due to restricted outlet to the river and provide the following wetland functions: flood storage, sediment retention, nutrient removal and transformation, and fish and wildlife habitat. The most significant wildlife function is the provision of feeding areas for wading birds (primarily herons and egrets). The temporarily or intermittently flooded areas primarily serve to provide flood storage.

In determining these wetland values it can be safely concluded that these areas perform the stated functions as effectively as other wetlands of similar type on the north coast of Puerto Rico. All of the wetlands in this area provide flood storage. The wetter sites provide habitat for wading birds. The sediment retention and nutrient removal functions are of lesser significance because the downstream area (the Atlantic Ocean) would not be expected to be impacted measurably by higher nutrient or sediment loads.

We have concluded that no damage will be caused by temporary ponding in existing wetlands. During flood events these ponding areas will hold water from interior drainage behind the levees. As flood waters recede the ponded water will be drained into the river. These low lying areas are normally inundated during floods. Significantly longer periods of inundation, when the project is complete, are not expected. Flowage easements will be obtained for these areas and designation for ponding will restrict future development to preserve their present status. If somewhat longer periods of inundation do occur there may be a shift to the more flood tolerant species discussed above. Such a change would not alter the area's overall, existing wetland functions.

As you noted, our plan includes a water control structure to provide water from the Rio de la Plata to the Rio Cocal. The relationship between the hydrology of Rio Cocal and Rio de la Plata has not been determined sufficiently to develop criteria for the regulation of the proposed structure. The primary sources of fresh water to the Rio Cocal system are groundwater and rainfall runoff within the Rio Cocal drainage basin. Water from the Rio de la Plata watershed overflows into the Rio Cocal basin during floods. The U.S. Fish and Wildlife Service advised that Rio de la Plata flow to the Rio Cocal is necessary to suppress soil salinity levels and to maintain a desirable inundation period on Rio Cocal mangroves. Determination of the appropriate design and operating criteria for the water control structure for desirable conditions will be addressed during the PED phase of this project.

No source of contaminants has been identified in the project area. Further review of records and additional consultation with the Puerto Rico Department of Natural Resources and Environmental Quality Board will be conducted prior to construction. Should there be reason for concern, material will be tested, and any contaminated materials that may be discovered will be disposed in accordance with Commonwealth and Federal regulations.

The location benefits were evaluated in accordance with Federal procedures contained in Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies. The evaluation of location benefits was performed in close coordination with the Puerto Rico Planning Board, which favors the concentration of future urban expansion adjacent to existing development. Estimates of future development were based on projected population growth and land use provided by the Puerto Rico Planning Board and are based on the most likely development scenarios expected with and without the project. Essentially the same data were included in the Environmental Impact Statement for the Dorado regional wastewater treatment Plant prepared by the Puerto Rico Aqueduct and Sewer Authority and adopted by your Agency. We have reviewed our results in view of your comments and feel that our estimates of benefits for the different alternatives are reasonable and appropriate for deciding among alternatives.

This project is in compliance with Executive Order 11990, Protection of Wetlands. Appropriate wetlands protection and enhancement measures have been incorporated into the plans, including flow provision to Rio Cocal mangroves. Mitigation is proposed to offset losses of mangroves at the mouth of the river. The ponding areas will serve to limit development. Further, I have identified practicable non-wetland disposal areas to avoid or minize impacts to wetland resources.

With regard to your concern over the Section 404(b)(1) evaluation, a Section 404(r) exemption is not intended. The present intention is to determine during PED if any discharges into wetlands are required and to use such determinations for obtaining water quality certification from the Commonwealth of Puerto Rico. The option of seeking Section 404(r) exemption remains viable during project processing for funding. Further, future non-Corps development in wetland areas which lie within the overall area receiving flood protection from this project will be subject to appropriate Department of the Army and Commonwealth permits.

We believe we have satisfied your concerns on this project and we propose to process the final Chief's report at expiration of the referral period, on December 9, 1988. The final Chief's report will indicate a change in the disposal areas as determined during coordination of the report.

Sincerely,

Patrick J. Kelly

Enclosure

Patrick J. Kelly
Brigadier General, U.S. Army
Director of Civil Works

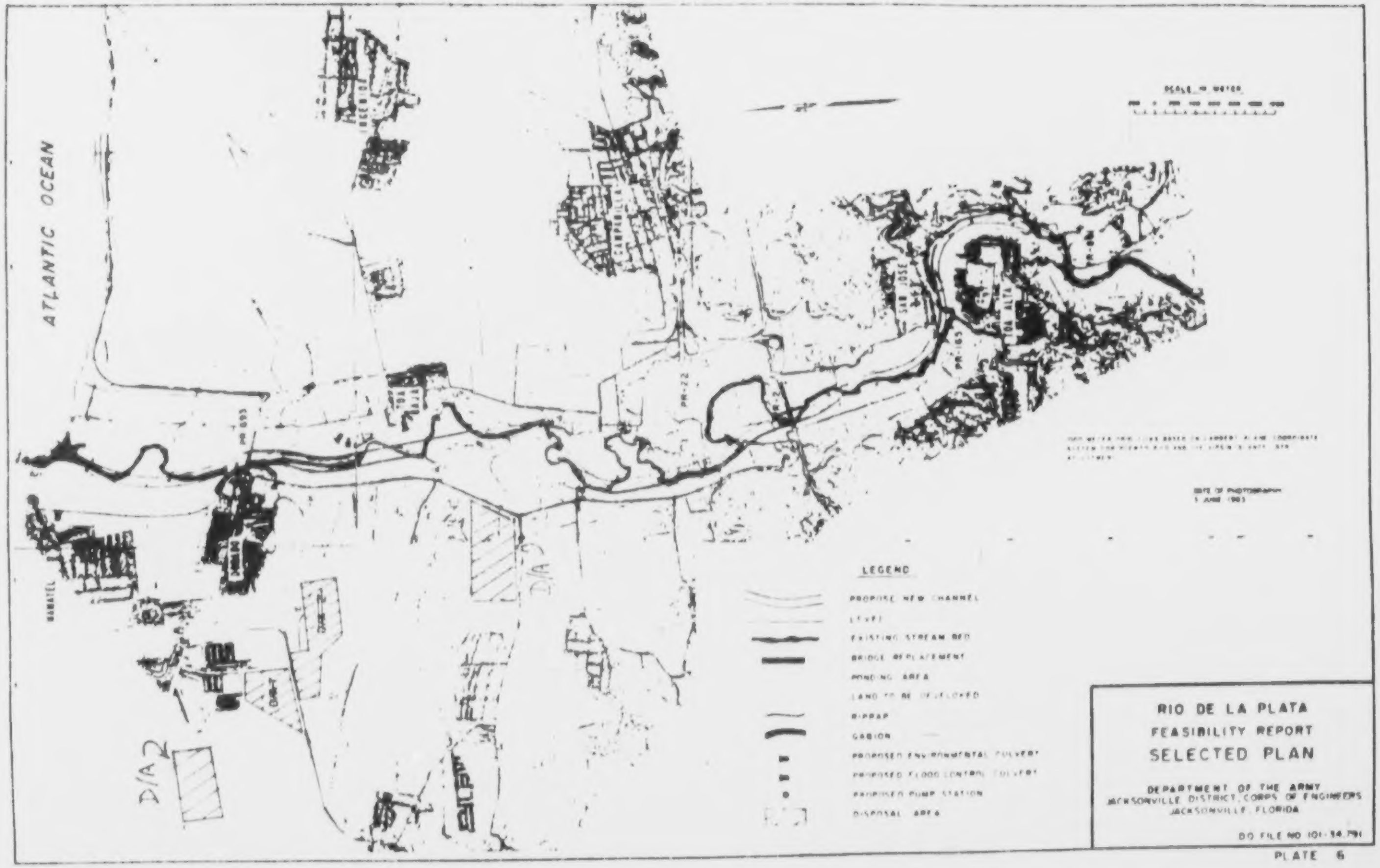
ATLANTIC OCEAN
INGENIO
CAMPANILLA
SAN JOSE
TOA ALTA
PR-165
PR-22
PR 693
D/A 2
SCALE IN METERS
DATE OF PHOTOGRAPHY
LEGEND
PROPOSE NEW CHANNEL
LEVEE
EXISTING STREAM BED
BRIDGE REPLACEMENT
PONDING AREA
LAND TO BE DEVELOPED
RIPRAP
GABION
PROPOSED ENVIRONMENTAL CULVERT
PROPOSED FLOOD CONTROL CULVERT
PROPOSED PUMP STATION
DISPOSAL AREA
RIO DE LA PLATA
FEASIBILITY REPORT
SELECTED PLAN
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
DO FILE NO 101-34,791

PLATE 6

RIO DE LA PLATA, PUERTO RICO

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF

CECW-PM (10-1-7a) January 3, 1989

SUBJECT: Rio de la Plata, Puerto Rico

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on Rio de la Plata, Puerto Rico. It is accompanied by the reports of the Board of Engineers for Rivers and Harbors and the District and Division Engineers. These reports are in final response to a resolution adopted 5 May 1966 by the Committee on Public Works of the United States House of Representatives. The resolution requested a review of the report of the Chief of Engineers on the Rio de la Plata and Tributaries, Puerto Rico, submitted to Congress on 23 May 1942.

2. The District and Division Engineers recommend authorization of a plan primarily consisting of 8.5 miles of channel widening and straightening; 9.8 miles of levees; relocation of bridges, utilities, buildings, and structures; and in-kind replacement of 5 acres of mangrove. The plan would provide standard project flood protection for all developments downstream of Puerto Rico Highway 2 (PR-2) and 100-year-frequency flood protection for the Toa Alta/San Jose area upstream of PR-2. The plan is the national economic development plan and would eliminate approximately 99 percent of average annual damages from riverine flooding of the Rio de la Plata. Based on October 1988 price levels, the estimated first cost of the recommended plan is $55,915,000 with a Federal share of $34,099,000 and a non-Federal share of $21,816,000. Average annual benefits and costs based on 8-7/8 percent interest and 50-year period for economic analysis are estimated at $9,983,000 and $6,023,000, respectively. The benefit-cost ratio is 1.7.

3. The Board of Engineers for Rivers and Harbors concurs in the findings and recommendations of the reporting officers. The Board finds the recommended improvements to be economically justified, engineeringly feasible, and environmentally acceptable. Accordingly, the Board recommends that flood damage reduction measures along Rio de la Plata, Puerto Rico, be authorized for implementation in accordance with the reporting officers' recommended plan, subject to cost sharing, financing and other requirements of Public Law 99-662 for projects of this kind.

4. I concur in the findings, conclusions, and recommendations of the Board. As a result of further coordination at the Washington level with the U.S. Environmental Protection Agency and the U.S. Department of the Interior, I have relocated the disposal sites. Our recent reevaluation of this issue indicates that practical alternatives to wetland disposal do exist. Sites approximately 800 meters west of Disposal Area 1 and approximately 1200 meters south of Disposal area 2 have been identified. This change was to avoid damages to wetlands. All environmental concerns will be further defined in the later preconstruction, engineering, and design phase.

5. The recommendations contained herein reflect policies governing formulation of individual projects and information available at this time. They do not necessarily reflect program and budgeting priorities inherent in the local and Commonwealth programs or the formulation of a national civil works construction program. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the Commonwealth, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

H. J. HATCH
Lieutenant General, USA
Commanding

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

DEPARTMENT OF THE ARMY
BOARD OF ENGINEERS FOR RIVERS AND HARBORS
KINGMAN BUILDING
FORT BELVOIR, VIRGINIA 22060-5576

REPLY TO
ATTENTION OF:
CEBRH-PL (10-1-7a)

9 May 1988

SUBJECT: Rio de la Plata, Puerto Rico

Chief of Engineers
Department of the Army
Washington, DC 20314-1000

SUMMARY OF BOARD ACTION

The Board finds that improvements for flood control along Rio de la Plata in the municipalities of Dorado, Toa Baja, and Toa Alta, Puerto Rico, are economically justified and environmentally and socially acceptable. The reporting officers' recommended plan primarily consists of 8.5 miles of channel widening and straightening; 9.8 miles of levees; relocation of bridges, utilities, buildings, and structures; and in-kind replacement of 5 acres of mangroves. The plan would eliminate approximately 99 percent of average annual flood damages from flooding of the Rio de la Plata. Based on October 1987 price levels, the estimated first cost of the recommended plan is $54,024,000 with a Federal share of $32,989,000 and a non-Federal share of $21,035,000. The benefit-cost ratio is 1.7.

SUMMARY OF REPORT UNDER REVIEW

1. AUTHORITY. This report is in response to a resolution of the United States House of Representatives, Public Works Committee, dated 5 May 1966. The resolution requested a review of the report of the Chief of Engineers on the Rio de la Plata and Tributaries, Puerto Rico, submitted to Congress on 23 May 1942. The resolution is quoted in the district engineer's report.

2. DESCRIPTION OF STUDY AREA. The Rio de la Plata basin, the third largest drainage basin in Puerto Rico, is in the north-central region of the island. The Rio de la Plata drains about 240 square miles and flows northward from its origin in the Sierra de Cayey Mountains to the Atlantic Ocean, a distance of about 63 miles. Its mouth is about 11 miles west of San Juan. The study area consists of the river's coastal floodplain upstream to near the town of Toa Alta, a distance of about 8 miles. The alluvial floodplain averages 4 miles in width.

3. The Rio de la Plata coastal valley is largely undeveloped, and natural and improved pastures are the dominant land use. Agricultural lands are primarily used for dairy farming. Urban occupation of the floodplain has significantly modified the vegetation. Growth along the riverbanks is minimal and limited to herbaceous plants. The river's water quality is generally poor. The study area is one of the richest zones of prehistoric and cultural resources in Puerto Rico.

4. ECONOMIC DEVELOPMENT

a. Total population of the Rio de la Plata basin in 1980 was about 290,800. Approximately 47 percent of the population lives in the municipalities of Dorado, Toa Baja, and Toa Alta which are basically dormitory areas of the San Juan metropolitan area. Manufacturing, tourism, government services, retail trade, and agriculture are the principal income and employment-producing activities. Levittown is the largest urbanized area in the floodplain.

b. The unemployment rate in the study area is over 20 percent and over half of the families are on welfare. All communities in the area are relatively well defined, high density settlements. The study area is becoming one of the fastest growing urbanized areas in Puerto Rico; however, continued urban expansion, particularly in the vicinity of Toa Baja and adjacent communities are limited because of a shortage of flood-free land.

5. EXISTING AND AUTHORIZED IMPROVEMENTS. There are no existing or authorized U.S. Army Corps of Engineers projects in the study area. Pertinent improvements constructed by the Commonwealth of Puerto Rico include the La Plata Dam, located about 3 miles upstream of the town of Toa Alta, and the Rio Bayamon Express and Rio Hondo Local Channels, flood control facilities east of Levittown. La Plata Dam controls 70 square miles of the basin and impounds approximately 30,000 acre-feet of water supply storage for the San Juan metropolitan area. The reservoir does not contain any flood control storage. The Rio Bayamon Express Channel provides a 220-year-frequency level of protection from flooding of the Rio Bayamon for areas north of the city of Bayamon including the Levittown area.

6. PROBLEMS AND NEEDS

a. Flooding is the most serious water resources problem in the study area. The town of Toa Baja is subject to inundation as frequently as every 2 years, and the entire community is flooded periodically to depths of 2 to 4 feet. Dorado, Ingenio, Toa Ville, and Campanillas are subject to inundation as frequently as every 5 years. Levittown has not experienced flooding from the

Rio de la Plata but would sustain approximately $133 million in flood damages during a 100-year-frequency flood event. Sixty-seven percent of all structures subject to damage from a 100-year-frequency flood on the Rio de la Plata are in Levittown.

b. Seven major known floods have occurred on the Rio de la Plata and were primarily associated with hurricanes or tropical storms. The flood of record, a 100-year-frequency event on 8 August 1899, was a result of Hurricane San Ciriaco. The second largest, a 50-year-frequency event, occurred on 13 September 1928. The most recent inundation took place in May and October 1985 when damages reached $12.8 million and severly affected over 2,000 families. These floods were estimated to be 10-year-frequency events. The standard project flood (SPF) would inundate about 13,100 acres including 2,200 acres of urban development; 7,500 acres of vacant open space; 1,600 acres of agricultural lands; and 1,800 acres of lagoons and wetlands. Inundation of this area by a SPF would affect 12,300 families, 329 industrial and commercial establishments, and numerous public buildings and other facilities. Damages to existing structures and contents from a SPF event would be about $287 million, while damages from a 100-year-frequency flood would total about $169 million. Total average annual damages for existing development are estimated at about $6.6 million, about 40 percent of which occur in Levittown.

7. IMPROVEMENTS DESIRED. Local interests desire Federal assistance in reducing flood damages in the coastal floodplain and enhancing opportunities for further urban development throughout the study area.

8. ALTERNATIVES CONSIDERED. A wide array of structural and nonstructural measures to reduce flood damages in the coastal floodplain were evaluated. Nonstructural measures included floodplain regulations, stormwater management, flood insurance, temporary and permanent floodplain evacuation and floodproofing. Structural measures included dams and reservoirs, channel improvements, and levees. Twelve plans were considered in the final array of alternatives including various combinations of the following measures: levees (including ring levees), channels, and relocation of the town of Toa Baja. Channel improvements were investigated at 10- and 25-year-frequency levels of protection and levees and combination plans at 100-year-frequency, SPF, and 500-year-frequency levels of protection.

9. PLAN OF IMPROVEMENT. The district engineer's recommended plan (revised plan E) provides for 8.5 miles of channel improvement from the mouth of the Rio de la Plata upstream to the vicinity of Toa Alta; 5.2 miles of levee adjacent to Puerto Rico Highway 165 (PR-165) to the east of the Rio de la Plata and

4.6 miles of levee adjacent to Puerto Rico Highway 693 to the west of the river, all downstream of Puerto Rico Highway 2 (PR-2); relocations of 3 bridges, 68 residential, and 47 nonresidential structures; construction of a pump station at Toa Baja; 7 drainage structures; 4 ponding areas totaling 695 acres; localized channel riprap; a cutoff wall at the upstream end of channel improvements; and in-kind replacement of 5 acres of mangrove at the mouth of the river. Materials excavated from the channel would be used to construct the two levees. Excess materials would be placed in two disposal areas south of Dorado. The plan would provide SPF protection and eliminate approximately 99 percent of average annual flood damages resulting from Rio de la Plata flooding. The plan would also prevent hurricane tidal surges from entering inland through the mouth of the river. Residual damages from potential coastal flooding associated with hurricane tide levels in the vicinity of Ingenio, Toa Ville, and Levittown, entering inland through the mouth of the Rio Cocal, are estimated at approximately $1.4 million and $22.2 million for the 100-year-frequency and SPF events, respectively. The recommended plan would also enhance 1,238 acres of land in the existing floodplain for urban development.

a. Channelization would generally follow the natural stream alignment, except for cutoff of a few channel meanders to minimize impacts on the environment and avoid cultural resource sites. Work would primarily involve channel straightening and widening to take advantage of the natural armor in the existing stream. The improved channel would have a bottom width of about 230 feet and would require excavation of approximately 6 million cubic yards (yd^3) of material. The channel would provide a 5- to 10-year-frequency level of protection downstream of Highway 2 and about a 100-year-frequency level of protection in the vicinity of San Jose and Toa Alta. Riprap would be placed in localized areas to insure stability against anticipated high velocities caused by levee constrictions, bridges, alignment curvature, or to safeguard against meandering where the channel is near the levees.

b. The recommended plan balances cut and fill by utilizing suitable material from channel excavation for construction of the proposed levees. Levee construction would require approximately 3.8 million yd^3 of material. The average height of the levee adjacent to PR-165 would be about 15.5 feet and would vary from about 5 feet to over 31 feet at Toa Baja. Average height of the levee adjacent to Highway 693 would be about 14.3 feet and would vary from about 9 feet to over 22 feet at the town of Dorado. A levee overbuild of 25 percent of its design height would be necessary to compensate for anticipated settlement. The design height also includes about 3 feet of freeboard.

c. The ponding areas would be located on vacant or agricultural lands used for grazing and sized to accommodate 100-year-frequency flows.

d. Crossover structures at 10 sites are included in the levee design to allow for continued cattle grazing in the floodway.

10. ECONOMIC EVALUATION. Based on October 1987 prices, the total first cost of the proposed project is $54,024,000, of which $32,989,000 would be Federal and $21,035,000 would be non-Federal under cost-sharing requirements of Public Law 99-662. Included in the non-Federal amount is the 5-percent cash contribution of $2,701,000 to be paid during construction of the project. Average annual charges, based on an interest rate of 8 5/8 percent and 50-year period for economic analysis, would be about $5,823,000 including $24,500 for annual operation and maintenance and periodic replacements. Average annual benefits are estimated at $9,755,000 and the benefit-cost ratio is 1.7.

11. PROJECT EFFECTS

a. ECONOMIC. The recommended plan would generate average annual net national economic development (NED) benefits of $3,932,000. Approximately 81 percent of average annual benefits are for reducing flood damages to residential, commercial, industrial, and public structures and their contents; 11 percent for location benefits; 7 percent for employment of previously unemployed labor resources; and 1 percent for emergency costs saved. The recommended plan has been identified as the NED plan.

b. ENVIRONMENTAL. Implementation of the recommended plan would require 265 acres for construction of the levees, including 5 acres of mangrove (that would be replaced in-kind) at the mouth of the river. Excess excavated material would be deposited at disposal sites (totaling 145 acres) within the area identified for location benefits. The disposal areas are palustrine, emergent, temporary to semipermanent wetlands. An additional 850 acres of natural pasture/intermittent wetlands would be replaced by urban development as part of the location benefits. Five cultural resource sites would be impacted by levee and channel construction and would be mitigated by data recovery and documentation. No threatened or endangered species would be adversely impacted.

c. SOCIAL. The well-being of people living in the project area would be improved by reducing frequent flooding and eliminating the burden of repeated repairs, replacement of property, and threat to personal health and safety. In addition, 1,238 acres of land currently subject to flooding would be protected and allowed to urbanize. This urbanization would potentially provide housing for an additional 36,400 residents. Sixty-eight residential and 47 nonresidential structures and buildings, primarily associated with 6 dairy farms, would have to be relocated due to project construction.

12. RECOMMENDATION OF THE REPORTING OFFICERS. The district engineer recommends that the plan for flood control improvements described in his report, as revised, be authorized for implementation as a Federal project. The division engineer concurs.

REVIEW BY THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

13. GENERAL. The board's review encompassed the technical, economic, social, environmental, and policy aspects involved in the flood control plan proposed by the reporting officers. The board considered whether the report and its supporting documentation conformed to the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and to other applicable administrative and legislative policies and guidelines. The board also considered the views of local interests, as well as those of Federal, State, and local agencies.

14. RESPONSE TO THE DIVISION ENGINEER'S PUBLIC NOTICE. The division engineer issued a public notice on 8 June 1987 stating the recommendations of the reporting officers and inviting interested parties to provide comments to the board. The board received one letter in response to the notice. A representative of the Policia de Puerto Rico, Dorado District, expressed support for channelizing the Rio de la Plata and identified several areas subject to flooding.

15. FINDINGS AND CONCLUSIONS. The Board of Engineers for Rivers and Harbors concurs in the findings and recommendations of the reporting officers. The proposed improvements are needed for flood damage prevention and are engineeringly feasible, economically justified, and environmentally acceptable. The plan recommended is the NED plan. The proposed project would not result in any significant environmental impacts. Any adverse long-term social impacts would be minor. The recommended plan is selected based on its positive contribution to economic development.

16. The board considered the incremental justification of the proposed channel upstream of PR-2 bridge in the vicinity of San Jose and Toa Alta. In addition to inundation reduction benefits in this reach, economic benefits would be realized by utilizing excavated levee construction materials from the reach in lieu of

using borrow material from more distant sites at increased cost. Economic efficiency in optimizing the proposed improvements would be achieved by balancing cut and fill for the entire project. Therefore, this channel reach is a critical element in the economic justification of the proposed project. The reporting officers have determined that if the upstream channel increment is not included, first costs for the project would increase approximately $5.3 million and Federal costs would increase approximately $7.3 million. This increase would be due to longer hauling distances for levee construction materials and the cost of a drop structure at the upstream end of the project. Therefore, the reporting officers conclude that construction of the upstream channel increment is not a separable element and that it should be included as part of the recommended plan. The board concurs with that conclusion.

17. In accordance with Public Law 99-662, non-Federal interests would be responsible for the requirements listed below. The non-Federal share of project costs under these requirements shall not exceed 50 percent of the cost of the project assigned to structural flood control.

a. All lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project, including suitable disposal areas and all necessary relocations other than portions of utilities which pass under or through the project's structure;

b. Holding and saving the United States free from damages due to construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the United States or its contractors;

c. Maintaining, operating, replacing, and rehabilitating, without cost to the United States, all flood control works in accordance with regulations prescribed by the Secretary of the Army;

d. A cash contribution of 5 percent of the cost of the structural project features assigned to flood control, to be paid during construction;

e. Additional cash contributions as are necessary so that the total contribution of non-Federal interests for the structural flood control features of the project is not less than 25 percent of the total cost of the project assigned to structural flood control; and

f. Participating in and complying with applicable Federal floodplain management and flood insurance programs.

18. **RECOMMENDATIONS.** The board recommends that flood damage reduction measures along Rio de la Plata, Puerto Rico, be authorized for implementation generally in accordance with the reporting officers' recommended plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost sharing, financing, and other requirements of Public Law 99-662 for this kind of project, and as otherwise provided by law, and with the provision that non-Federal interests will agree to comply with the following specific requirements:

a. At least annually, inform affected interests regarding the limitations of the protection afforded by the project;

b. Prior to initiation of construction, enact ordinances and promulgate regulations to prevent construction and encroachment on the levees, channels, and other project works that would reduce their flood-carrying capacity or hinder maintenance and operations, and control development in the project area to prevent undue increase in the flood damage potential, or require compensation actions that would allow the continued proper functioning of the project for flood control;

c. Publicize floodplain information in areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project; and

d. Adopt and enforce regulatory measures to assure that project lands in the created floodway will be used for project-compatible purposes; such compatibility determination shall lie with the Secretary of the Army acting through the Chief of Engineers.

19. The recommendations contained herein reflect policies governing formulation of individual projects and information available at this time. They do not necessarily reflect program and budgeting priorities inherent in the local and Commonwealth programs or the formulation of a national civil works construction program. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the Commonwealth, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

FOR THE BOARD:

GEORGE K. WITHERS, JR.
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

RIO DE LA PLATA SURVEY INVESTIGATION

SYLLABUS

The Río de la Plata Survey Investigation was conducted under a resolution adopted in May 5, 1966, by the Committee on Public Works of the House of Representatives. Preliminary investigations were carried out during the late 1960's and early 1970's but were halted because of changes in priorities by the Commonwealth Government of Puerto Rico regarding flood control projects. In 1982 the studies were continued at the request of the local government. The purpose of the study was to investigate flooding problems associated with the overflow of Río de la Plata in the area of Toa Alta, Toa Baja, and Dorado, Puerto Rico, with a view to determine the need for, and feasibility of, improvements to solve the flood problems.

The Río de la Plata basin drains an area of 624 square kilometers into the Atlantic Ocean at a point some 18 kilometers west of San Juan. Heavy rainfall combines with very steep slopes to produce relative high discharges in a relative short period of time. Flooding in the study area affects over 12,000 families and numerous public buildings and facilities. Average annual damages for existing conditions are estimated at $6.6 million, while average annual equivalent damages are expected to reach $7.5 million without the project.

Revised Plan E, which combines channel improvement from the mouth of the river to the vicinity of the town of Toa Alta, levees adjacent to Highway 165 in the east and highway 693 in the west, and ponding areas, culverts, and a pump station to deal with interior drainage of developed areas, is the recommended plan because it maximizes net national and regional economic development benefits. Total first cost of this plan would be $53.0 million while total investment cost would reach $64.8 million, which amount to an annual cost of $5.7 million. Total estimated annual benefits of $9.3 million result in a benefit/cost ratio for the recommended plan of 1.6/1.0. Though the plan would contribute $1.0 million of annual locational benefits, it is also justified on purely existing inundation damages prevented. The benefit/cost ratio for existing conditions is 1.2/1.0. Under the current cost sharing policy, as established in the Water Resources Development Act of 1986, the Federal Government cost would be $32.3 million while the non-Federal cost would amount to $20.6 million.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

RIO DE LA PLATA SURVEY INVESTIGATION

MAIN REPORT

I. INTRODUCTION

A. Authority and Purpose. A resolution adopted by the Committee on Public Works of the House of Representatives on May 5, 1966, provides the authority for this investigation. The resolution reads as follows:

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the La Plata River and Tributaries, Puerto Rico, submitted to Congress on May 23, 1942, with a view to determining whether improvements in the interest of flood control and allied water use are advisable at this time."

The purpose of the investigation was to determine the feasibility of implementing flood control measures to alleviate the flooding problem in the area caused by the overflow of Río de la Plata.

Initial investigations were undertaken in the late 1960's and early 1970's; however, they were halted as a result of changes in study priorities and land use plans for the San Juan Metropolitan Area by the Government of the Commonwealth of Puerto Rico. In 1982 the Governor of Puerto Rico requested the study be continued (refer to Appendix F). In 1982 Congress appropriated funds for continuation of investigations.

B. Study Participants. This investigation was thoroughly coordinated with Commonwealth and Federal agencies, the mayors of the municipalities of the study area, as well as with interested groups and individuals (refer to Table 1). The Puerto Rico Department of Natural Resources (DNR) was the primary agency representing the Commonwealth Government throughout the planning process. The Corps of Engineers had the responsibility of conducting and coordinating the study.

Formal and informal meetings with state field offices and municipal governments of Dorado and Toa Baja helped in assuring consideration of relevant and acceptable flood control alternatives and other major infrastructure development projects for the area. A continuous effort was made during the investigation to have the local representatives, particularly the Assistant Secretary for the Area of Flood Control of the Department of Natural Resources and her staff, as equal partners in the identification of the problems and the formulation and evaluation of flood control plans.

C. The Report and Study Area. This investigation is documented in a main report, environmental impact statement, and six appendices. The main report documents the study area water needs and problems, the plan formulation and evaluation process, the conclusions and recommendations of the study and environmental impact assessment of the candidate plans

TABLE 1

PARTICIPATING GOVERNMENT AGENCIES AND INSTRUMENTALITIES

Federal

- Department of the Interior
  - U.S. Geological Survey
  - U.S. Fish & Wildlife Service
  - National Marine Fisheries Service
  - National Park Service

- Department of Transportation
  - Federal Highway Administration

- Environmental Protection Agency

- Department of Housing and Urban Development

- Department of Agriculture
  - Soil Conservation Service

- Department of Commerce
  - National Weather Service
  - Office of Coastal Zone Management

- Federal Emergency Management Agency

Commonwealth

- Office of the Governor
  - Planning Board
  - Environmental Quality Board
  - Office of the Budget

- Civil Defense

- Office of the Resident Commissioner

- Department of Natural Resources

- Department of Transportation and Public Works

- Department of Agriculture

- Department of Sports and Recreation

- Department of Housing

- Department of Social Services

- Department of Education

- Police Department

- Legislature of Puerto Rico
  - House of Representatives
  - Senate

- Aqueduct & Sewer Authority

Local

- Municipio of Dorado
  - Office of the Mayor of Dorado
  - Office of Budget and Planning

- Municipio of Toa Baja
  - Public Affairs Office
  - Planning Office

- Municipio of Toa Alta
  - Civil Defense

The appendices contain supporting data and detailed investigations of various aspects of the study including hydrology and hydraulics, geotechnical and materials investigations, design and costs, economic analysis, and assessment of the study area cultural and natural resources.

The overall study area consists of the entire Río de la Plata basin, which includes all or part of the municipalities of Dorado, Toa Baja, Toa Alta, Comerío, Cidra, Cayey, Aibonito, and Barranquitas (refer to Figure A-1). The detailed study area, however, consists of the river's coastal flood plain up to the vicinity of the town of Toa Alta (see Plate 1). This is the area where most of the flooding occurs. In this report reference to the study area refers to the three municipalities in the detailed study area, i.e. Dorado, Toa Baja, and Toa Alta.

D. Prior Studies and Reports. Previous studies on the Río de la Plata flood plain have focused on the identification of the flooding problem and its mapping. They include a Flood Plain Information Report prepared by the Corps in 1965, a Flood Atlas based on the 1960 floods published by the U.S. Geological Survey in 1964, and the Federal Emergency Management Agency Flood Insurance Map prepared in 1979. A Flood Hazard Mitigation Report prepared by DNR in 1982 suggests several measures, i.e. levees and relocation to deal with the area's flooding problem but did not enter into the detailed economic and engineering investigations to formulate and evaluate those measures.

II. RESOURCES AND ECONOMY OF THE STUDY AREA

A. Physiography and Climate. Río de la Plata basin is located in the north central region of Puerto Rico. The main geographic features in the basin are the Cordillera Central Mountains, which form the central spine of the island, the river valleys, and the coastal plain. Significant tributaries are the Río Hondo, Río Arroyata, Río Usabón, and the Río Guadiana. Río de la Plata rises at an elevation of 903 meters above mean sea level on the northerly slopes of the Sierra de Cayey mountains. It flows generally west and north through the towns of Cayey, Comerío, Toa Alta, Toa Baja, and Dorado as shown in Figure A-1. The main stream drains an area of 624 square kilometers (241 square miles), and after a distance of 101.5 kilometers it enters the Atlantic Ocean at a point about 16 kilometers west of San Juan.

The terrain in the northern portion of the basin consists of a low alluvial coastal plain. Proceeding south the terrain rises through an area of karst topography (the result of the weathering of limestone), rolling foothills, and finally climbs to the northern slope of the Cordillera Central and the northern slopes of the Sierra de Cayey. The headwater areas exhibit extremely steep slopes and narrow stream channels. River slopes range between 2 and 60 meters per kilometer.

There are in the basin two water supply reservoirs and two small structures for hydropower. Lake Carite, the uppermost reservoir, has a capacity of 11,300 acre feet and controls 21.2 square kilometers of the basin. Most of its water is used for irrigation and municipal purposes in the south coast of Puerto Rico. An old 4,640 KV hydropower generation system at Carite is being rehabilitated. Two small hydropower dams in the vicinity of the town of Comerío, with a total capacity of 5,240 KV, were abandoned in the early 1970's because of siltation of impoundments and relatively high production cost. The second reservoir, Lake La Plata, was constructed in 1974. The dam controls 181.2 square kilometers, has a capacity of 27,700 acre feet, and provides the San Juan Metropolitan Area with about 50 mgd. None of the reservoirs have any flood control storage.

The basin has a subtropical climate, with average monthly temperature ranging between 22° C and 26° C. Average annual rainfall over the basin varies between 135 and 203 centimeters. This relatively small amount of rainfall for an interior area is because it is leeward of the Luquillo mountains, which deplete the tradewinds of their moisture.

B. Socio-Economic Profile. Total population of the Rio de la Plata basin in 1980 was 290,782 (see Table 2). Approximately 47 percent (135,667) of this population lives in the detailed study area of Dorado, Toa Baja, and Toa Alta, which are basically dormitory areas of the San Juan Metropolitan Area. Between 1970 and 1980 the population of the detailed study area grew about 64 percent or 53,000 persons. With the construction of the De Diego Expressway connecting San Juan and Arecibo, on the north coast, the detailed study area is becoming one of the fastest growing urbanized areas in Puerto Rico. By the year 2000 population of this area, according to the Puerto Rico Planning Board, is projected to be 176,000 persons. This projection is based on no flood control project for the area. Although most of this development is taking place on flood free lands, there is still a large percentage (17 percent) of the detailed study area's total population residing in the flood plain.

Manufacturing, tourism, government services, retail trade, and agriculture, in that order, are the principal income and employment producing activities in the study area. There are 70 manufacturing plants employing some 6,074 persons. These plants are devoted to the manufacture of apparel, electrical, and chemical products produced mostly for export. There are two resort hotels in Dorado which have over 800 rooms, employ some 1,700 persons, and occupy some 1,800 acres of land. They provide accomodations for domestic and foreign tourists who visit the area for entertainment and recreation. Currently these hotels are investing $75 million in improvements and expansion of their facilities. The area of Dorado, because of its excellent recreational facilities and amenities, has attracted numerous middle and high income families seeking second homes. The combined budget of the three municipal governments in the study area for FY-86 is about $12 million and allows for the employment of approximately 1,000 persons. The number of commercial and service oriented establishments in the study area, according to the 1982 Business Census of the U.S. Department of Commerce, is estimated to be 272 with sales of $202.4 million and 1,753 employees. Agriculture, particularly dairy farms and ornamentals, is another important economic activity in the study area.

In spite of the increased number of industrial plants and retail trade and service oriented outlets that have followed the population into the suburbs of the detailed study area, the unemployment rate is over 20 percent, and half of the families are on the welfare list.

TABLE 2

1980 POPULATION FOR THE MUNICIPALITIES IN THE RIO DE LA PLATA BASIN

MUNICIPIO	POPULATION
Dorado	25,511
Toa Baja	78,246
Toa Alta	31,910
Naranjito	23,633
Barranquitas	21,639
Comerío	18,212
Cidra	28,635
Aibonito	22,167
Cayey	41,099
TOTAL	290,782

Source: 1980 Census of Population for Puerto Rico, Bureau of Census, U. S. Department of Commerce.

It could be many years before the study area and for that matter the entire island of Puerto Rico would be able to obtain a high rate of economic growth, self-sufficiency, and a significant reduction in the unemployment rate. The Commonwealth Government recognized this problem and devised a new economic development strategy based on: (a) a diversified and dynamic international manufacturing sector attracted to the island through local and Federal tax exemption measures, availability of highly skilled and productive labor force, free entrance to the United States market and promoting the island as the major production and distribution center of manufactured goods for the Caribbean region; (b) modernization of agriculture and the shift towards production of profitable commodities through the use of model farms, modern technology, and business-minded farmers; (c) expansion of tourism facilities and services, and integrating them with the island culture, and converting Puerto Rico into the transportation hub for all the Caribbean tourism industry; (d) huge capital investment program for maintenance and expansion of infrastructure and public utilities; (e) promotion of an extensive entrepreneur capacity to establish and manage retail trade and service oriented outlets; and (f) a comprehensive set of incentives for local savings and investment.

Future economic growth and development in Puerto Rico depends on the effectiveness of these policies and programs in attracting foreign and domestic capital investment in agriculture, manufacturing, tourism, and trade.

C. Natural Resources. The Río de la Plata basin falls within the Subtropical Moist Forest Ecological Zone as defined by the Forest Service of the U.S. Department of Agriculture. This zone covers about 58 percent of the total area of Puerto Rico, and is characterized by a mean annual rainfall of 1000 mm to about 2000 mm and a mean biotemperature between about 18° C and 24° C. During March and April moisture deficits are a serious problem while considerable runoff characterizes the last 3 to 6 months of the year. On an annual basis moisture regimes in this zone are almost ideal, with sufficient water to support agriculture but no excessive wetness.

Natural and improved pastures are the dominant use in the Río de la Plata mountainous and coastal areas. The basin has been mostly deforested. There are some patches of trees existing on the steepest slopes and mountain tops in the upper parts and in the karst hills (mogotes) in the lower reaches. Mangrove stands are also found near Mameyal and along Río Cocal. There are remnants of alluvial swamp forests south of Highway 867 and in Ciénaga de San Pedro. Mangroves and lagoons in the flood plain cover about 1,800 acres.

The predominant soils in the upper part of the basin are the Múcara-Caguabo soils which are moderately deep, very steep, and well drained soils of the humid mountainous areas. In the flood plain the alluvial soils are of the Toa-Bajura-Coloso type, which are deep, level, moderately drained to poorly drained soils. Cash crops, vegetables, tobacco, and ornamentals are grown in the Cidra, Cayey, Aibonito and Barranquitas area. Dairy farms and ornamentals predominate in the alluvial flood plain.

Fish and wildlife in the study area are not as diversified and valuable as in other river estuaries on the north coast, but the small mangrove area at the river's mouth and the lower reaches of the river do support a variety of birds and fishes.

No threatened or endangered species are known to be in the study area. However, the project area is located within the range of at least two Federally listed endangered species. The brown Pelican is likely to occur in the vicinity of the river mouth. Likewise, even though the Puerto Rican Boa was not observed, it may occur within the project area.

Vegetation along the banks of the river is minimal and limited to herbaceous vegetation. Considerable sections of the river upstream of Toa Baja show vertically eroded banks. This is due to frequent flooding and high velocities in the river channel. Downstream from Toa Baja the existing channel has a 40-meter width and a water level depth of 3-meters with almost vertical slide slope. This section has very few meanders. The section of the river between Toa Baja and Roa Alta has more meanders and water depth of less than 2 meters.

According to the P.R. Environmental Quality Board, water quality standards for fecal coliforms and dissolved oxygen have been violated in the Río de la Plata. In the near future, this problem will be reduced as a result of the construction of the Dorado Regional Wastewater Treatment Plant. Also, according to USGS investigations, sea water encroachment poses a problem to groundwater in the study area. Studies by the P. R. Environmental Quality Board do not show presence of contaminated materials in the study area.

D. Cultural. The study area, according to the cultural reconnaissance study (refer to Appendix E), is probably one of the richest zones of prehistoric and historic cultural resources in Puerto Rico but there is little documentation.

One of the most important sugar mill sites on the island of Puerto Rico, the Hacienda Santa Elena, is listed on the National Register of Historic Places (NRHP) and in the inventory of the Historic American Buildings Survey (HABS).

The cultural reconnaissance field study identified 36 other potential cultural sites throughout the study area. The nature and characteristics of those sites to be impacted by the recommended plan will be examined in detail during a cultural survey study previous to construction of a flood control project for the area.

E. Recreational Resources. Recreational resources and opportunities abound in the study area due to its physiographic characteristics and the large amount of vacant open space. The study area has over 5 kilometers of relatively good beaches and coastal frontage, over 150 acres of developed recreational areas, and the lower reaches of Río de la Plata provide sports boating and fishing. The karst hills (mogotes) offer attractive and enjoyable visual aesthetic, and the diversified recreational facilities at the Dorado hotels substantially expand the recreational infrastructure of the study area. The residents of the study area also enjoy good accessibility to the active and passive recreational facilities of the San Juan Metropolitan Area.

III. PROBLEMS AND NEEDS

A. Flooding.

1. General. The Rio de la Plata has a well-defined channel and low normal flow except during storm periods. Then, the waters overflow the flood plain in the flat lowland areas and rise against canyon walls in the confined reaches. The broad alluvial flood plain is wider below Toa Alta, averaging about 6 kilometers in width. Above the coastal plain,width of the flood plain varies from less than 1 kilometer to about 100 meters, with the exception of the valley at the Cayey plateau which is somewhat wider. Most land subject to periodic flooding is used for pasture or is vacant. However, the towns of Dorado, Toa Baja, and Toa Alta and several other urban communities located in the coastal flood plain frequently experience serious flooding. The entire town of Toa Baja is periodically flooded to depths of 0.6 to 1.2 meters.

There have been 7 major floods on Río de la Plata. Details of the hydrologic characteristics of these floods are shown in Appendix A. The August 8, 1899, flood and the September 13, 1928, flood are considered the 100-year and 50-year floods, respectively, at the Toa Alta gaging station. The most recent floods occurred during May and October 1985.

2. Areas Subject to Flooding. The entire town of Toa Baja and portions of the town of Dorado, Toa Alta, Levittown, and the communities of Mameyal, Toa Ville, Ingenio, Campanilla, and San José are subject to flooding even from high frequency floods such as the 10-year flood (refer to Table 3). The SPF flood would result in about 3 meters of water above ground level for most of the urban developments, while the 10-year flood would produce a depth of about 1 meter in many of them. Plates 2 and 3 show the delineation and water depth zones of the 100-year flood and the Standard Project Flood. The SPF inundates about 13,100 acres of land. Only 2,200 acres of this land have been developed into relatively high density urban settlements. The rest of the lands are in vacant open space (7,500 acres), agriculture (1,600 acres), mangroves, and lagoons (1,800 acres). Under existing conditions floodwaters would remain for over 12 hours throughout most of the flood plain (refer to Plates 4 and 5), thus creating a threat to the lives and health of the population in the area, damaging property, and disrupting all productive economic activities. Developed areas in the flood plain become inaccessible even with small floods such as the 5-year flood frequency.

Table 4 shows the specific developed areas subject to flooding and number of structures affected. The SPF would affect some 12,154 families most of them middle and low middle class families and some 331 industrial and commercial establishments. Over 150 kilometers of streets and roads would be unusable. Numerous public buildings and facilities would also be affected.

Details on the properties subject to flooding are provided in Appendix D.

3. Flood Damages. During the last 15 years the study area has been declared a flood disaster area by the President 5 times. During the floods of 9 October 1970 the Municipality of Toa Baja was inundated more than 1.2 meters by floodwaters, and flood damages reached $4.2 million. Some 60 housing units were completely destroyed.

TABLE 3

EXISTING CONDITIONS: DEPTH OF FLOODING
(mts above ground)

Developed Area	SPF	Floods 100 Yr.	10 Yr.	6-7 Oct 1985
Mameyal	2.8	2.0	0.9	1.0
Town of Dorado	2.7	2.0	1.2	1.2
San Antonio	0.8	0	0	0.5
El Polvorín	3.3	2.1	1.1	1.7
Town of Toa Baja	3.3	2.5	0.5	0.75
Toa Ville	3.8	3.0		2.8
Ingenio	2.7	1.8	0.7	1.2
Campanillas	3.2	2.5	1.2	1.2
Levittown	2.5	1.4	0	0
Toa Alta & San José	1.6	1.3	0	0

TABLE 4

EXISTING CONDITIONS: AFFECTED AREAS AND STRUCTURES

		Structures			
Developed Area	Residential	Commercial	Public	Industrial	Others
Mameyal	346				
Town of Dorado	302	2	1	2	3
San Antonio	93				
El Polvorín	142				
Town of Toa Baja	412	33	15	11	5
Toa Ville	121	2			
Ingenio	1,086	17	1		
Campanillas	755	3	2		7
Levittown	8,303	260	11		17
El Cocal	28	---	--		--
Town of Toa Alta & San José	566	1	1		1
TOTAL	12,154	318	31	13	33

Hurricane Eloise in 1975 flooded all the communities in the flood plain to more than one meter in depth and according to the newspapers, damages to the three municipalities in the detailed study area exceeded $8.6 million.

Hurricanes David and Frederick in 1979 also flooded the entire flood plain and resulted in damages of over $5.0 million. Two persons drowned during these floods.

In 1985 the study area was flooded twice (May and October) with floods equivalent to the 10-year flood. Flood damages reached $12.8 million. Over 2,000 families were severely affected.

Under existing conditions the 25-year flood would result in damages of $ 22.3 million, the 100-year flood would produce a $168.8 million damage, while the SPF would produce damages reaching $287.2 million. The substantial increase in damages result from the flooding by major floods of Levittown, the largest urban development in the detailed study area. Most of the families residing in this development are subject to flooding from the 100-year flood and SPF. Average annual damages for existing development are estimated at $6.6 million while average annual equivalent damages would reach $7.5 million. Increase in average annual damages between existing and future conditions only reflects the increase in the value of contents of residential areas. Details on historical and potential flood damages are in Appendix D.

B. Water Supply. At present, the water demand of the municipalities of Dorado, Toa Alta, and Toa Baja is being met from La Plata reservoir, which yields about 50 mgd. The demand at all other municipalities within the basin is met by surface water diversions and ground water. The well fields in the alluvium flood plain of Río de la Plata produce some 9.0 mgd that complement the surface water from Río de la Plata dam to serve the western part of the San Juan Metropolitan Area. Results from the Puerto Rico Island-Wide Water Supply Study (IWWSS) completed by the Corps of Engineers, Jacksonville Engineer District, in 1980, suggest that though present water demand in the municipalities of Dorado, Toa Alta, and Toa Baja is being met, the area will experience serious water shortages in the intermediate and long-term periods unless water conservation measures are implemented and/or new surface and ground water sources are developed. To meet future water demand in the area, the IWWSS suggests improvement of metering, reduction of system leakages, installation of water saving devices, modification of plumbing codes, increases in the price rate structure, and importation of water from the Dos Bocas and Caonillas Reservoirs in the north-central region of the island. Many of these measures are being incorporated into PRASA's Water Supply Plan for Puerto Rico. Currently, PRASA is designing an aqueduct to bring to the study area and the San Juan Metropolitan Area 40 mgd from a diversion in the Río Manatí, located in the north central coast of Puerto Rico.

C. Land Use. The coastal valley of the Río de la Plata, north of PR Highway 2, is largely undeveloped. The urban area of Toa Baja and the adjacent communities have not expanded due to the unavailability of flood-free land in the area. In addition, the P.R. Planning Board in its Land Use Master Plan for the San Juan Metropolitan Area (SJMA) of 1980 adopted a policy to control development in the La Plata valley as a measure to counterbalance the urban sprawl that has characterized the development of the SJMA and to preserve most of the flood plain, particularly east of the river for agricultural purposes.

Construction of a flood control project will enhance a considerable amount of land in the flood plain. According to the P.R. Planning Board Land

Use Policies for Puerto Rico and the P.R. Department of Agriculture, most of the lands will remain or go to agriculture uses.

IV. PLAN FORMULATION RATIONALE

A. General. Plan formulation involved the identification, analysis, and evaluation of alternative flood control management plans that addressed the planning objectives within a set of constraints and using certain assumptions and criteria.

B. Planning Objectives. Four planning objectives evolved from the analysis of the study area's problems, needs, and opportunities relating to its natural resources. In particular, there is a critical flooding problem in the area that seriously affects the safety of its residents and the area's potential for growth. The specific objectives guiding this study are:

1. To safeguard the lives of about 50,000 residents in the flood plain of the Río de la Plata.

2. To reduce property losses in the Río de la Plata coastal flood plain due to periodic flooding.

3. To enhance opportunities for further development throughout study area.

4. To preserve the Río de la Plata coastal flood plain environmental and cultural resources.

C. Planning Constraints. Several physical features in the flood plain pose limitations to the type and design of flood control works that could be considered. The presence of the town of Toa Baja in the middle of the flood way present the most critical planning constraint. A second limitation relates to the steep slopes (over 35°) of the upper part of the basin and the high discharges (over 100,000 cfs) associated with the low frequency floods. The fan shape characteristic of the flood plain with several dense population clusters scattered throughout it affect the relevant flood control alternatives. The location of the San Pedro Ciénaga in the eastern extreme of the flood plain constitutes another factor in the formulation of flood control measures for the area. The availability of open space points towards levees as relevant alternatives but such measures would require ponding areas, culverts, and pumping to deal with local drainage. Land enhancement potential for agriculture and urban development purposes calls for channel improvements and/or levees.

D. Planning Assumption and Criteria. Several technical and economic assumptions and criteria were established to guide the plan formulation process. They are as follows:

1. Technical

a. High discharges, high velocities, short time to peak, and lack of transportation escape routes in the flood plain require that degree of protection and type of design minimize potential for catastrophic results should project works fail.

b. Expected insignificant differences between existing and most probable future hydrologic conditions for the entire basin allow for the design flood to be based on existing hydrologic conditions.

c. Measures to deal with interior flooding in the coastal flood plain must take into consideration increased runoff to result from increased development projected for part of the enhanced flood plain.

d. Proposed plans should minimize residual flooding and damages.

e. Plans of improvements must protect their respective areas without causing major adverse flooding effects elsewhere.

f. The spatial discontinuity among the various dense developments in the flood plain requires a separate hydraulic analysis of each area.

g. A project performance appraisal would help establish the acceptability of the recommended plan.

2. Economic and Financial

a. Total beneficial contribution of the plans must exceed total adverse impacts, and one of the plans must maximize net national economic development benefits.

b. No community would be protected at the cost of worsening the flooding condition at another community.

c. Future urban development with and without project conditions must be consistent with P. R. Planning Board Land Uses Policies and Guidelines.

d. Location benefits for enhanced land to be developed with and without project conditions is based on land filled cost. Those from land to be developed only with project conditions are derived on the basis of market value of land.

e. The benefits and costs would be expressed in comparable qualitative economic terms to the fullest extent possible. Annual benefits and costs are based on a 50-year life period and an interest rate of 8 5/8. Costs and benefits reflect dollars of May 1986.

E. Without Project Conditions. The without project conditions scenario would be equivalent to the no-action plan that envisions no flood control works for the study area. To accommodate part of the increase in population, some 389 acres of current floodable land will be developed through land filled.

Potential flood hazard to the life, health, and property of the residents in the area would remain as the most critical problem. Periodic disruption of productive economic activities in the area would impair further economic development. Relocation of all the activities seems unlikely because nowhere else are similar locations and agglomeration economies available. The without-project condition serves as a bench mark to assess and evaluate the candidate flood control plans.

V. IDENTIFICATION OF MEASURES

A. General. The development of plans to achieve the planning objectives was initiated with the consideration of all possible measures to reduce flood damages in all identified flood prone towns and communities. Concurrently, consideration was given to possible ways of achieving the objectives not specifically concerned with the flooding problem, especially those which could facilitate its economic growth. All the measures were analyzed to determine their applicability and general feasibility in the study area. Subsequently, the management measures considered appropriate for solving the flooding problem were assembled into an array of potential flood control alternatives. These alternatives were progressively screened and refined throughout the entire planning process until a set of final candidate plans was produced.

B. Description of Measures.

1. Flood Plain Regulations. The Puerto Rico Planning Board has adopted a Flood Plain Zoning Regulation (Regulation No. 13) for guiding development in flood plains throughout the island. The regulation describes the policies and standards for 3 floodable zones. Zone 1 refers to vacant lands within the major or regulatory floodway, defined as the 100-year flood. New construction is prohibited in this zone. Zone 2 refers to land between the flood way and the limits of the flood plain or flood way fringe. Here new buildings are permitted if they are properly flood proofed, the first floor elevation is higher than the regulatory flood stage (100-year flood), and obstruction to flow of water is minimized. Zone E (Special) refers to already urbanized lands within the regulatory flood way. Urban development and redevelopment in this zone must meet the same conditions as Zone 2. In 1987 the P. R. Planning Board revised Regulation Number 13 to make it consistent with FEMA Flood Plain Management Guidelines under its Flood Insurance Program.

The implementation of Regulation No. 13 has limited new urban developments in the Río de la Plata flood plain. This has helped to reduce flood damages not only to potential new developments but to existing development as well, by eliminating potential increases in flood stages from the potential new developments.

The effectiveness of Regulation No. 13 in reducing the rate of growth of flood damages favors its inclusion in the with and without-project conditions.

2. Storm Water Management. Storm water management has as a main objective: the preservation and restoration of the flood carrying capacity of natural streams and drainage facilities. In already developed areas in the flood plain, this objective could be accomplished by maintenance and improvement of the storm drainage systems. In the undeveloped areas, storm drainage systems could be complemented with land use occupation and building regulations to minimize contribution of new development to flood runoff. In the upper parts of the basin, the possibility exists for implementing certain land development practices, i.e. no improvement of natural channel of streams and construction of small retention lagoons, land occupation measures, and multiple residential buildings that may significantly reduce increased runoff from new developments. Local authorities have acknowledged that implementation of some of these measures could be tied up with the final design for flood control along the Río de la Plata. The Puerto Rico Planning Board is already requesting developers to implement some of these practices to minimize increased runoff in high developed basins. Therefore, this measure was also considered as part of the without and with project conditions.

3. Flood Insurance. Puerto Rico entered the Emergency Flood Insurance Program in 1972 and the Regular Flood Insurance Program in 1978, both administered by the Federal Insurance Administration. Flood insurance would serve to reimburse property owners for damages sustained and, thus, would partially contribute to the objective of reducing financial and personal losses within the basin. However, because of the frequency of flooding in the area, insurance premiums will be so high that most property owners would not be able to afford them. Also, flood insurance would not help strengthen the area's economic base. Nonetheless, the measure is also part of the without and with project conditions.

4. Temporary Flood Plain Evacuation. Temporary evacuation of persons and personal property from flood prone areas can be very effective when operated in conjunction with a reliable flood forecasting system and where mobile, damageable objects are concerned. However, most damage susceptible property in the area is immobile, and the flash-type floods prevalent in the basin make it impossible to implement an effective flood forecasting system to protect property. The Puerto Rico Department of Natural Resources is implementing for the Río de la Plata flood plain a warning system based on rain fall in the upper part of the basin. This system would be in effect during the next fiscal year and was included in the with and without project conditions.

5. Permanent Flood Plain Evacuation. Since the town of Toa Baja sits in the middle of the river floodway and is a small urban settlement isolated from the rest of the urban areas of the municipality, the possibility of relocating it was considered a relevant measure to solve its flooding problem and avoid a catastrophe that may result from very large floods.

6. Flood Proofing. Flood proofing methods were studied for the public office buildings and residential structures. The methods involve structural changes which would allow flood waters to rise around the structures with little or no damaging effects. However, flood proofing techniques would not eliminate damages outside main structures, loss of access, loss of business, utility and community interruptions, and potential dangers to public health and safety. The primary approach to flood proofing has been to protect structures by excluding flood waters from entering them. This involves installing gate valves in drain lines and sanitary sewers and installing bulkheads in doorways and windows and constructing a second story on residential structures where flood waters exceed 1.5 meters above first flood elevation.

Practically all structures in the study area are built of reinforced concrete. The construction is characterized by foundations, columns and beams of reinforced concrete and mostly concrete block walls. Some structures utilize bearing walls in lieu of a concrete frame system of columns and beams. The reinforced concrete floor slab is poured over compacted ground. The cost of raising a typical house structure to protect against flooding was estimated at about $50,000. The structural integrity of floor, columns, and beams would not sustain raising the building. Also, there is a high risk of differential foundation settlements causing wall cracks and possible beam failures since the building is not designed to be subjected to the loads associated with raising the structures. Preliminary engineering, aesthetics, and cost analysis indicated that raising of residential and public facilities structures would be impracticable because of current construction practices on the flood plain. Therefore, such measures were eliminated from further analysis.

7. Dams and Reservoirs. Dams and reservoirs reduce downstream flooding by temporarily withholding and gradually releasing flood water as downstream capacity allows. A reservoir site on Río de la Plata 2.5 kilometers above the town of Comerío was investigated for this potentiality. Though the reservoir would control 262.4 square kilometers (101.3 square miles) of the Río de la Plata, total flood stage reductions in the flood plain area would not be significant because of the effect of runoff from the intervening area. The possibility of using this site for water supply and allocating all the storage capacity at the existing PRASA water supply dam 26.8 kilometers downstream to flood control was investigated, but the effects in the flood plain water stages were also insignificant. Dams and reservoir were, therefore, not considered any further.

8. Channel Improvements. Widening and deepening the present channel of Río de la Plata and minor route realinement from its mouth to the vicinity of the town of Toa Alta would provide relief. Some type of velocity-control measures would probably necessarily accompany any channel-realinement projects. Bridge openings at PR Highways 693, 2, 165, and 861 would require enlargement.

Channel improvements could be expected to lower flood stages and flood damages, increase property values, and enhance the security and general welfare of flood plain residents. Associated health problems experienced during flooding would be eliminated or reduced. Additionally, channel improvements would reduce the anxiety associated with unexpected flood occurrences and the inconveniences associated with temporary disruption of economic production, employment, community services, transportation, utilities, and other community amenities. Channel improvements would also reduce temporary isolation of residents during flooding. The channel improvements would contribute significantly to most of the planning objectives and, therefore, were considered as a potential flood control measure for the area.

High cost and potential significant adverse environmental impacts rendered channel diversion to the east of P. R. Highway 165, a nonacceptable measure for flood control in the area.

9. Levees. This type of measure is considered a relevant application to the study area's flooding problem because they have beneficial effects similar to those of channelization, and there is considerable open land in the vicinity of the communities to be protected, thus, reducing significantly the real estate costs for the levees.

VI. DESCRIPTION AND ASSESSMENT OF CANDIDATE PLANS

A. General. Eight candidate plans combining different measures and providing protection against the SPF evolved from the intermediate and final planning process. During the report preparation lower degrees of protection (10-, 25-, and 100-year floods) were examined but differences of more than one meter in the water surface profiles, substantial residual flooding and damages and potential for a catastrophe with widespread loss of human lives and property, should the project works fail suggested that a higher level of protection be provided. Specifically, in the case of an alternative containing levees and channel improvements similar to those under Plan E, but to protect against the 100-year flood, the residual flood stages resulting from the overtopping of the levee by the SPF would average over 2.0 meters from ground level throughout most of the existing developed areas and would produce flooding equivalent to the 25-year flood. Also, plans with SPF level of protection resulted in higher net national economic benefits than plans with lower degree of protection.

Initially, six alternative plans were investigated for solving the flooding problem throughout the study area. These alternatives were developed with the intent of solving the flooding for all floodable areas or communities in the basin. The plans were compared on the basis of degree of protection afforded, residual flooding and damages, costs, benefits, net benefits, completeness and acceptability. The analysis resulted in Plans E and F having the greatest net benefits and being the most efficient and acceptable plans. Subsequently, all plans were analyzed on an incremental basis for each major plan component and by community or group of communities being protected by a major project component of the plan. This analysis also revealed Plans E and F to be the most efficient, complete, and acceptable. The analysis also revealed that certain components of Plans E and F, specifically the ring levee and pump stations for the Toa Baja/San José area were not economically justifiable as a last added increment to the levees, channel, and bridge replacements considered under Plans E and F. This analysis resulted in considering two additional plans (revised Plans E and F) in the final analysis for a total of eight plans.

When the incremental feasible portions of all the plans were compared, revised Plans E and F show the highest net national benefits. The next step was to compare in detail the beneficial and adverse impacts of revised Plans E and F.

The economic, engineering, and environmental comparison between revised Plans E and F resulted in selecting revised Plan E since it maximizes net benefits and is also the most efficient, complete, and acceptable plan.

In order to establish that the level of protection for revised Plan E corresponds to the NED Plan that maximizes net benefits, revised Plan E was compared with plans providing lower and higher levels of protection. One of these comparisons was with revised Plan E without channel which provides protection against the 100-year flood. The comparative analysis demonstrates that revised Plan E with SPF protection maximizes NED benefits.

The following paragraphs describe the main tasks followed in assessing the candidate plans.

1. Each candidate plan was analyzed for potential adverse impacts and beneficial effects.

2. These impacts and effects associated with each plan were compared with the defined base condition of the without-project conditions for the study area. Attention focused on those impacts that would likely have material bearing on the decision making process. The magnitude of the impacts was measured and quantified where possible, but often involved a qualitative descripti of the effects of a measure.

3. Under all plans the construction of a section of the levee in the vicinity of Mameyal will result in the loss of 5 acres of mangroves. Therefore, all plans will consider planting an equal acreage of mangroves east of the levee.

4. All plans considering the levee adjacent to PR Highway 165 will incorporate a structural feature to allow for fresh water from Rio de la Plata to flow into Rio Cocal.

5. Maximum Net Benefits and Efficiency Each plan was examined to define the Maximum Net benefits produced and cost efficiency. Alternative plans were developed that provided 10-year, 25-year, 100-year, SPF and 500 year levels of protection. The maximum net benefits were produced at the SPF level of protection. Individual project components were incrementally analyzed with pumps and impoundment areas evaluated for maximum efficiency. The recommended plan was further refined to match cut from the channel to fill requirements for the levees. The recommended plan will be the NED (National Economic Development) plan which maximizes net benefits.

B. Description of Plans.

1. Plan A. This plan considers using ring levees to protect the towns of Dorado, Toa Baja, and Toa Alta and the communities of Mameyal, San Antonio, and Polvorin in the municipality of Dorado and Toa Villa, Ingenio, Campanillas, and San Jose in the municipality of Toa Baja against the SPF. Refer to Plate A-4 and Tables A-22 through A-35 in Appendix A for schematics of plan and design data. The plan provides no protection to Levittown, the largest urbanized area in the flood plain. The general characteristics of the proposed levees for each developed area are shown in Table 5. The existing channel is straightened for about 1.23 kilometers and its cross-section augmented to 20 meters wide with a side slope of 1 on 4 and deepened to 1.3 meters (msl) in the vicinity of the town of Toa Baja to eliminate existing bends that would cause severe levee erosion. The plan also calls for

TABLE 5

SUMMARY CHARACTERISTICS OF CONSIDERED LEVEES UNDER PLAN A

Area	Length Kms	Average Height from Ground (mts)	Remarks
Dorado	2.49	5.0	Runs along entire eastern and southern sectors. Section close to river would be lined with gabions Bridge on PR Hwy 693 would be replaced and road raised.
Mameyal	1.48	3.0	
Polvorin	1.48	5.0	
San Antonio	0.57	2.8	
Toa Baja	3.15		Circles entire town. Sections close to river would be lined with gabions. Ramps over levee.
Ingenio	5.1	5.5	Ramps over levees.
Campanillas	2.2	5 to 4	Ramps over levees.
To Alta	2.2	8.0	Runs along eastern sector. Replacement of Hwy 861 bridge. Construct road to Toa Alta. Section close to river would be gabion lined.
San José	1.4	10.0	Sections close to river would be lined with gabions

replacement of 2 bridges (PR Highway 693 and PR Highway 861), construction of a road near Toa Alta, and ramps over the ring levees.

2. Plan B. This plan is the same as Plan A except that it considers the relocation of the town of Toa Baja and the community of Toa Ville. Plate A-5 and Tables A-22 through A-35 in Appendix A provide the schematic and design data of this plan. The relocation of the two areas does not have a significant impact on the water stages on the rest of the developed areas in the flood plain when compared with Plan A. This is because the two developments cover an area of less than 200 acres out of a flood plain of 13,100 acres.

3. Plan C. This plan proposes a levee adjacent to Highway 165 from the coast to high lands in the vicinity of Highway 2, the relocation of the town of Toa Baja, and ring levees for the other affected towns and communities as suggested under Plan A. Refer to Plate A-6 and Tables A-22 through A-35 in Appendix A for schematic and design characteristics of Plan C. The plan would protect all developed areas to the east including Levittown. Since the flood plain storage capacity is reduced about 75 percent, water surface profile in the western part increased between 1 and 3 meters as does the backwater in the vicinity of the town of Toa Alta. The plan would include replacement of the bridges on PR Highways 693 and 861, construction of a road near Toa Alta, ramps over ring levees, and raising a road (PR Highway 693) leading from PR Highway 165 into town of Dorado. The town of Toa Alta and community of San José would be protected with the ring levees suggested under Plan A.

4. Plan D. This plan is the same as Plan C except that it would extend the levee adjacent to Highway 165 along the northern, western, and southern sections of the town of Toa Baja to protect it (refer to Plate A-7 and Tables A-22 through A-35 in Appendix A for details). The levee adjacent to Highway 165 would run for 8.2 kilometers. Table 6 summarizes characteristics of levees considered under Plan D. There is no significant impact on the water surface profiles in the vicinity of the developed areas in the western part as compared with the stages under Plan C. The existing channel would be improved as in Plan A. The town of Toa Alta and the community of San José would be protected with similar levees to those proposed under Plan A.

5. Plan E. This plan suggests a combination of channelization and levees. The existing channel would be realigned and improved with cross-section of 50 meters in the bottom, a bottom elevation going from -6.0 meters to +5.5 meters (msl), and side slope of 1 on 4 from the mouth of the river up to south of the town of Toa Alta (13.6 kms.) The improved channel would require replacing the bridges on PR Highway 693 (eastern entrance to Dorado), PR Highway 861 (south of Toa Alta), PR Highway 165 (leading to Toa Alta), and PR Highway 2. The east levee would have the same alignment adjacent to Highway 165 as in Plan D and the west levee would connect the ring levees at Mameyal and Dorado under Plan A and extend southward adjacent to PR Highway 693 to high lands near PR Highway 2. The town of Toa Alta and the community of San José would be protected by ring levees similar to those proposed under Plan A. These levees would be 2-3 meters lower than those under Plan A. Refer to Plate A-8 and Tables A-22 through A-35 for details. The levee adjacent to PR Highway 165 runs for 8.4 kilometers, while the west levee adjacent to PR Highway 693

TABLE 6

SUMMARY CHARACTERISTICS OF CONSIDERED LEVEES UNDER PLAN D

Area	Length Kms	Average Height from Ground (mts)	Remarks
Dorado	2.49	7.0	Same as in Plan A.
Mameyal	1.48	5.0	
Polvorín	1.48	6.0	
San Antonio	0.57	5.8	
Toa Alta	7.25	9.0	Same as in Plan A.
San José	1.4	10.5	Same as in Plan A.
P.R. Hwy 165	8.2		
At coast		4.6	
At north tip of Toa Baja		6.8	
At central-eastern entrance of Toa Baja		7.3	
At south tip of Toa Baja		6.0	
At crossing with Hwy 2		5.0	

extends for 7.3 kilometers. Table 7 shows the height of the levees at selected points.

6. Plan F and Revised Plan F. These plans are the same as Plan E but without the channelization. Details of Plan F are on Plate A-9 and Tables A-22 through A-35 of Appendix A. The height of the west and east levees is shown for selected points in Table 8. The levees under this plan are about 3 meters higher than those under Plan E. Revised Plan F is the same as Plan F but without the ring levees and associated interior drainage facilities for the Toa Alta/San José area. These latter elements are not economically justified.

7. Revised Plan E. As the name indicated, this is a revised version of Plan E. The levees adjacent to P. R. Highway 165 and 695 will follow the same alignment as under Plan E. However, in order to minimize environmental impacts, avoid cultural resource sites, and increase channel stability, the channel alinement was modified to approximate the natural water course. In an effort to maximize the stability of the channel, the design bottom was raised to approximate the natural bottom and increased conveyance was provided by increased width (70 meters). One side slope and as much of the existing bottom would be utilized as possible. Two other bottom widths (50 and 100 meters) were investigated, but the 70 meters bottom width optimizes excavated materials for construction of levees. As a result, the channel improvement extends up to the vicinity of the Toa Alta/San José area and in addition to excavated materials for levee construction, provides incidental 100-year flood level of protection to this area. The disposal material was accordingly minimized to that quantity considered not satisfactory for levee construction. The levee alinement was changed in the vicinity of Toa Baja to increase the protected area. Detailed incremental analysis indicated that the levee and interior drainage facilities were not needed at San José and Toa Alta and have been eliminated from this plan. The one remaining pump station at Toa Baja was relocated to an area to minimize residual damages. The plan includes several ponding areas to hold the 100-year flows and an interior collection system. Six culvert structures were increased in capacity to pass the 100-year flows. A cut-off wall was incorporated at the upstream end of the channel improvement. Two fresh water discharge culverts were added to the project at Río Cocal and at a local tributary. The channel improvement will require replacing the bridges on P. R. Highways 693, 2, and 165. Major features of this plan are shown in Plate A-8A. A summary of levee data is shown in Tables A-22 through A-35. Plates A-11 & A-12 show the hydraulic design profiles for the levee. A summary of hydraulic design data for the channel is shown on Table A-21A. The height of the west and east levees is shown for selected points in Table 7A of this report.

C. Impact Assessment

1. Plan A. This plan considers ring levees to alleviate the flooding problem in each of the developed areas affected by flooding except Levittown. Levittown is the largest urbanized area in the flood plain. It has 67 percent of all the structures subject to flooding. The area, however, is not subject to frequent flooding. The possibility of a ring levee along the western edge of the Levittown area was examined. However, cost of over $25.0 million and major impact of such a measure on the gravity drainage system of that area and the San Pedro lagoon and wetlands lead to discard protecting Levittown with a ring levee. This plan would reduce expected average annual inundation damage by only 50 percent. The ring levees would create considerable interior flooding, varying between 0.5 and 1.2 meters for the 10-year flood and SPF, respectively, at most developed areas. This would require intensive and costly pumping that represents 50 percent of the total construction cost of the Plan. The ring levees would also require building ramps over levees in order to reach into the communities. A ring levee around the town of Dorado would require replacing a bridge on PR Highway 693 leading into town from PR Highway 165. Since the principal highways and roads leading into the various urbanized areas would be flooded, these areas would become isolated during flooding. The construction of the 20.07 kilometers of ring levees would take some 263 acres of agricultural lands and require 2,478,000 cubic meters of material which would come from a nearby fill material quarry. Except for the destruction of some 5 acres of mangroves to construct a section of the levee in the vicinity of Mameyal, no other significant beneficial or adverse short- or long-term impact on the natural, environmental, and recreational resources of the study area are expected to result from the construction of Plan A. During construction there would be some minor temporary adverse impacts on air quality, water quality, and aquatic life from clearing and excavation in the construction of levees, transportation of fill materials. and alignment of existing river channel in the vicinity of Toa Baja. The channel improvement excavation would involve only 190,000 cubic meters to be deposited on nearby upland sites.

The ring levee in the vicinity of Toa Baja will impact one archeological site. No land enhancement is achieved under Plan A for the ring levees would be adjacent to the developed areas.

Total first cost of Plan A is $45.5 million. Annual cost including operations and maintenance as well as replacement costs is 5.1 million, while annual benefits would be $4.4 million. Plan A shows a benefit/cost ration of 0.9/1.0.

2. Plan B. In addition to the impacts expected under Plan A, this plan would have major social disruption impacts as a result of the relocation

TABLE 7

HEIGHT FROM GROUND OF LEVEES UNDER PLAN E SELECTED POINTS (mts)

Adjacent to Hwy 165		Adjacent to Hwy 693	
Coast at Sta. (81+20)	1.7	Northeastern end of Mameyal at Sta. (72+00)	3.8
North end town of Toa Baja at Sta. (56+00)	3.7	Southeastern end of Mameyal at Sta. (64+00)	4.6
West end town of Toa Baja at Sta. (47+00)	8.2	Entrance to Dorado from Hwy 165 at Sta. (52+00)	6.6
South end town of Toa Baja at Sta. (38+00)	4.8	At Intersection with Hwy 694 at STa. (17+00)	4.6
Crossing of Hwy 2 at Sta. (16+00)	3.0	At Intersection with Hwy 659 at Sta. (6+00)	3.1

TABLE 7A

HEIGHT FROM GROUND OF LEVEES UNDER REVISED PLAN E AT SELECTED POINTS (mts)

Adjacent to Hwy. 165		Adjacent to Hwy. 693	
Coast at Sta. (81+20)	2.7	Northeastern end of Memeyal at Sta. (72+00)	4.9
North end town to Toa Baja at Sta. (56+00)	3.0	Southeastern end of Mameyal at Sta. (64+00)	4.9
West end town of Toa Baja at Sta. (47+00)	8.6	Entrance to Dorado from Hwy 165 at Sta. (52+00)	6.9
South end town of Toa Baja At Sta. (38+00)	5.3	At Intersection with Hwy 694 At Sta. (17+00)	4.7
Crossing of Hwy 2 At Sta. (16+00)	3.4	At Intersection with Hwy 659 at Sta. (6+00)	4.3

TABLE 8

HEIGHT FROM GROUND OF LEVEES UNDER PLAN F AT SELECTED POINTS (mts)

Adjacent to Hwy 165		Adjacent to Hwy 693	
Coast at Sta. (81+20)	4.0	Northeastern end of Mameyal at Sta. (72+00)	4.6
North end town of Toa Baja at Sta. (56+00)	6.4	Southeastern end of Mameyal at Sta. (64+00)	5.7
West end town of Toa Baja at Sta. (47+00)	11.4	Entrance to Dorado from Hwy 165 at Sta. (52+00)	8.4
South end town of Toa Baja at Sta. (38+00)	7.9	At Intersection with Hwy 694 at STa. (17+00)	7.4
Crossing of Hwy 2 at Sta. (16+00)	6.3	At Intersection with Hwy 659 at Sta. (6+00)	7.2

of the town of Toa Baja and the community of Toa Ville. This would entail relocating 564 families. The construction of the levees would require 215 acres of agricultural lands, while the relocation of the town of Toa Baja and the community of Toa Ville needs some 168 acres of flood free lands. The cost of relocating these communities is $65.1 million, which on an annual basis is 25 times the annual inundation damages to be avoided by relocating the communities.

This would require larger and higher ring levees and additional pumping to protect the communities in the western part of the flood plain.

Total first cost of the plan is $90.5 million while annual cost reaches $10.5 million. The benefit/cost ratio for the plan is only 0.4/1.00. The ring levee in the vicinity of the town of Dorado will affect one archeological site.

3. Plan C. This plan would significantly alleviate the flooding problem for all of the urbanized areas and agricultural lands east of PR Highway 165. Fill material for the construction of the levee would amount to 3,998,000 cubic meters, 43 percent of which would be to construct the 7.8 kilometers of levee adjacent to PR Highway 165. The developments in the western part would be protected by ring levees. Ninety-five percent of the study area's expected annual flood damage potential is avoided under this plan. The plan, however, would create considerable social disruption as a result of the proposed relocation of the town of Toa Baja. The community of Toa Ville is protected by the levee adjacent to PR Highway 165. The reduction of over 60 percent of the flood plain storage area as a result of implementing this plan would bring an increase in backwater effects of about 1.0-1.5 meters in the vicinity of the community of San Jose and the town of Toa Alta and approximately 1.0 meter along all areas in the western part of the flood plain. This would require higher ring levees as well as additional pumping to protect the communities in that area. About 5,370 acres of land would be enhanced, but only 73 acres are expected to be urbanized. This land will develop with and the without project conditions. The rest of the enhanced land would be maintained or allocated for agricultural uses.

There would still be large volumes of surface water flowing from the Rio Cocal system into the mangroves and lagoon of the Cienaga San Pedro. Flood water discharges for the Rio Cocal basin range from 8,150 cfs for the 5-year flood to 15,300 for the 100-year flood event. Also, a structural fixture will be incorporated into the levee adjacent to PR Highway 165 to allow for fresh water from Rio de la Plata to flow into Rio Cocal.

Short-term effects on the environment as a result of construction of this plan are similar to those under Plan A. Details of these impacts are presented in the Environmental Impact Statement.

This plan would not adversely affect archeological sites. Some 13 sites will be protected from flooding.

Total first cost of this plan is $109.4 million, annual cost is $12.1 million, and the benefit/cost ratio is 0.7/1.0.

4. Plan D. This plan would have essentially the same impacts as Plan C, but would not create the major social disruption associated with the relocation of the town of Toa Baja. Since the levee would be just along the eastern bank of the river adjacent to PR Highway 165, there will be induced higher stages and damages to the developments on the western side. Developed areas formerly not flooded will be subject to flooding. Of the land enhanced, only 141 acres are expected to be urbanized. This land will be developed with and without the project conditions. The rest of the enhanced land would remain or go into agricultural uses.

Total first cost of this plan is $62.3 million with annual cost of $6.9 million. The benefit cost ratio of this plan is 1.2/1.00.

5. Plan E. This plan would practically eliminate all riverine flooding (99 percent) to urbanized areas and agricultural lands east of the levee adjacent to Highway 165 and west of the levee adjacent to PR Highway 693 and north of the town of Dorado. Also under this plan the area of Toa Alta/San Jose is protected by construction of ring levee and pump stations. Under this plan residual flooding and the need for pumping is reduced significantly because most of the flood water would flow by gravity and through culverts to the improved canal. The plan would make some 1,238 acres of land available for urban development. Some 389 acres of this land would be developed with and the without project conditions. The rest of the protected flood plain would remain or go into agricultural uses (approximately 5,600 acres) and mangroves and lagoons (about 1,800 acres). Most of the land particularly to the east of the project would remain in agriculture, while in the west a significant portion of the flood protected lands would go to urban development. Also, about 1,500 aces of current pasture vacant lands would remain as part of the river floodway. This land could be used for pasture and grazing most of the time.

The channel improvements would require replacing 4 bridges and relocating 2 roads, one near the town of Dorado and the other near the town of Toa Alta. Three water supply lines varying in size from 6 inches to 15 inches crossing the bridges would also be replaced. The channel improvements alone will protect the Dorado-Toa Baja area against the 10-year flood. When combined with the levees, the degree of total protection is the SPF. The channelization does not impact the trestle bridge on the De Diego Expressqway.

Construction of the levees would require 367 acres of land, including 5 acres currently on mangroves to build a section of the Mameyal levee, and 1,674,000 cubic meters of fill material. Much of this material is expected to be obtained from the 5,604,000 cubic meters to be excavated for the widening and deepening of the channel. The rest would be deposited on four upland disposal sites. The plan includes the replanting to the east of the Mameyal levee of an equal amount of mangroves to that lost as result of the construction of the levee in that area. Construction of the levees would require relocating 26 housing structures, 17 small commercial establishments, and 3 agricultural buildings. Designation of floodway between the levees would require relocating 42 residential structures, 5 commercial and industrial establishments, and 18 agricultural small buildings.

Disturbance and destruction of aquatic life along the Rio de la Plata can be expected to result from construction of the channel improvements. Excavation and fill placement operations would create turbid conditions interfering with fish respiration and producing settlement of solids on bottom dewelling organisms. Also, the channel improvements considered under Plan E would increase stream velocities in various sections of the river which would result in additional scouring of the steam bed and, in turn, increase turbidity. Elimination of the curves in the river would remove slow velocity areas of the stream, which serve to reduce suspended sediment levels and lower turbidity.

The levee and channel improvements will affect 7 archeological sites and may affect 3 additional sites. Another 7 sites may be indirectly affected. The historical sugar mill site will remain within the flood way of the river. The project will reduce floodings to some 13 additional potential archeological sites, east of PR Highway 165.

Total first cost of plan E is $61.5 million while total annual cost is $6.4 million and annual beneifts reach $8.8 million. The plan has a benefit/cost ratio of 1.4/1.0.

6. Plan F and Revised Plan F. Impacts of these plans are similar to those under Plan E except that the beneficial and adverse effects relating to the channel improvements would not materialize. Under Plan F the area of Toa Alta/San Jose is protected by ring levee and pump stations but under revised Plan F this area is not protected because it is not incrementally justified. High velocities along the existing channel will result in an increase of erosion of banks, scouring of stream bed, turbidity, and sedimentation. Also, the need for higher levees would result in a loss of 7 acres of mangroves in the vicinity of Mameyal.

The construction of the levees adjacent to PR Highways 165 and 693 will impact on 2 archeological sites and 7 sites may be indirectly affected. The project will reduce flooding to some 13 additional archeological sites, east of PR Highway 165.

Total first cost of the Plan F is $72.5 million while annual costs and benefits are $8.0 million and $9.5 million, respectively. The benefit/cost ratio for Plan F is 1.2/1.0. Total first cost of revised Plan F is $65.3 million, while annual costs and benefits are $7.1 and $9.4 millions, respectively. The benefit/cost ratio of revised Plan F is 1.3/1.0.

7. Revised Plan E. Impacts of this plan with respect to reduction in flood damages, land use, relocation of buildings and structures, and replacement of bridges are similar to those under Plan E. But impacts relating to volumes of material excavated, used, and disposed, and environmental and cultural impacts from channel improvements are less adverse than under Plan E. The channel under revised Plan E was designed to use an alignment based on the natural watercourse in an effort to minimize impacts on the environment and avoid areas having cultural resources. The channel design bottom profile has been designed to avoid excavation of the natural stream bottom and take full advantage of natural armor. Channel conveyance has been improved by increasing the width rather than depth of the channel resulting in increased channel stability. The sizing of the channel was optimized with the amount of levee material needed to provide the most economically efficient sizing. Localized channel riprap was included to ensure stability in areas of anticipated high velocities caused by levee constructions, bridges, alinement curvature, or proximity of the channel to the levees in order to safeguard against meandering. Meanders are left unfilled to avoid adverse environmental impacts.

Total excavated materials for the main channel improvement and interior drainage channels under revised Plan E amounts would be about 4.6 million cubic meters, which is about 20 percent less than under Plan E. Usable materials for construction of levees is approximately 2.9 million cubic meters. The volume of nonusable materials to be disposed at two upland disposal areas would be about 1.7 million cubic meters, which is less than half the disposal excavated material under Plan E. As a result, disposal acreage under revised Plan E is only 145 acres as compared to 332 acres under Plan E.

The levee and channel improvement under the revised Plan E will affect 5 identified cultural resources as compared to 17 considered subject to direct or indirect impacts under Plan E. The Hacienda Santa Elena (listed on the National Register of Historic Places), the Santa Elena Prehistoric Site (also expected to be National Register eligible), and the Puente de los Reyes (an important historic bridge) will not be adversely affected. The plan will also reduce floodings to some 13 additional potential archeological sites east of PR Highway 165.

Total first cost of revised Plan E is $53.0 million; total investment, including interest during construction, would reach 64.9 million; and annual cost, including operation and maintenance if $5.7 million. The implementation of the plan will result in annual benefits of $9.3 million. The benefit/cost ratio for the plan is 1.6/1.0.

Table 9 summarizes the system of accounts for the candidate plans. Details of costs and benefits figures are in Appendix D. Impacts on the affected environment are evaluated in the Environmental Impact Statement.

VII. EVALUATION OF PLANS

A. General. The purpose of this analysis is to arrive at a recommended plan on the basis of the contributions of the candidate plans to the planning objectives and the trade-offs among the plans.

B. Contributions to the Planning Objectives.

1. Safeguard Personal Life. Safeguarding the lives of some 50,000 persons living within the Rio de la Plata flood plain is considered the ultimate objective of any flood control management program in the area. This is particularly so when most of the population belongs to low- and low-middle income families striving toward improving their living conditions. All plans would contribute to reduce the threat to life. Plans A and B, however, provide the least reduction because 8,?03 families in the Levittown area are left unprotected from very large floods.

2. Minimize Property Losses. The study area is part of the San Juan Metropolitan Region. It is basically a dormitory area with thousands of people commuting every day to work in San Juan. Total investment in the flood plan in housing and public facilities as well as contents amount to several hundred million dollars; therefore, reducing potential flood damages to this property is a critical objective of this report. The criteria utilized to measure contribution of each plan to this objective was reduction of inundation damages. Total expected annual inundation damages under the without-project conditions were estimated at $7.5 million. Plans A and B reduce them by 50 percent. Plans C and D provide for 95 percent reduction. Plan E and revised Plan E provide 99 percent reduction, and Plan F and revised Plan F result in 98 percent reduction of flood damages.

3. Minimize Social Disruption. This objective refers to minimizing adverse impacts on social cohesiveness of a particular community and/or their attachments to particular cultural and historical features. The residents of the town of Toa Baja and the community of Toa Ville are opposed to Plans A, B, and C because they isolate them from the rest of the communities in the municipality or would have them relocated from their premises. Plan D would not result in any significant social disruption. Plans E, F, and revised Plans E and F will require the relocation of 68 families from the designated floodways. Quality of life of these families is expected to improve since they will be moving from low quality wooden frame houses in the dairy farm areas to concrete houses within existing developed areas. Plan D would allow for the integration of separate urbanized areas dispersed throughout the municipality

TABLE 9
SUMMARY SYSTEM OF ACCOUNTS
(All Figures in $1,000 of May 1986)

	Plan A Ring Levees	Plan B Ring Levees & Relocation of Toa Baja	Plan C Levee Adjacent to Hwy 165 and Relocation of Toa Baja	Plan D Levee Adjacent to Hwy 165 Protecting Toa Baja	Plan E Levees Along Hwy 165 and 693 and Channel	Plan F Levees Along Hwy 165 and 693	Plan E Revised Levees Adjacent to Hwy 165 & 693 & Channel Improvement	Plan F Revised Levees Adjacent to Hwy 165 & 693
1. National Economic Development Effects								
A. Value of increased output of goods and services (annual)								
1. Flood Control								
Inundation Benefits	3,740	3,807	7,134	7,108	7,335	7,335	7,306	7,395
Location Benefits	-	-	39	89	1,022	1,022	1,022	1,022
Emergency Costs Saved	73	73	77	77	77	77	77	77
2. Redevelopment Benefits	622	522	1,426	800	403	1,020	886	897
Total Beneficial Effects (annual)	4,435	4,402	8,676	8,074	8,837	9,454	9,291	9,391
B. Value of Resources Required for the Plan								
Total Investment Cost	56,695	112,770	136,185	77,585	72,075	90,270	64,850	80,150
Annual Costs	5,118	10,014	12,068	6,949	6,392	7,951	5,709	7,090
Net Beneficial Effects (annual)	-	-	-	1,125	2,445	1,503	3,582	2,301
Benefit/Cost Ratio		0.4	0.7	1.2	1.4	1.2	1.6	1.3

TABLE 9 (Cont.)
SUMMARY SYSTEM OF ACCOUNTS
(All Figures in $1,000 of May 1986)

	No-Action Alternative (Without Project Conditions)	Ring Levees Plan A	Ring Levees and Reloc. of Toa Baja Plan B	PR Hwy 165 Levees Plan C	PR Hwy 165 Levees and Reloc. of Toa Baja Plan D	Levees and Channel Plan E	Plan E Revised	Levees Without Channel Plan F and Plan F Revised
IA. Environmental Effects								
A. Cultural Resources	37 identified sites will remain subject to flooding and erosion.	Toa Baja levee may adversely affect one site.	Levee around Dorado may adversely affect one site.	No adverse effects. Thirteen (13) identified sites will be protected from future flood damages.	Same as Plan C.	Levee and channel construction will affect 7 sites and may affect an additional 3 sites. Another 7 sites may be indirectly affected by increased erosion. Thirteen (13) identified sites will be protected from flooding.	Levee and channel construction would affect 5 sites. Thirteen sites will be protected from periodic flooding.	Levee construction will affect 2 sites. As in Plan E, another 7 sites may be subjected to erosion damage, and 13 will be protected from future flooding.
B. Flora Wetlands	No impact.	Loss of 3 acres of mangroves. Loss of some grasses and terrestrial vegetation in construction of diversion channel and some riverine vegetation in backfilling eliminated meander.	Same as Plan A, except impacts associated with diversion channel are eliminated.	Same as Plan B.	Same as Plan A.	Same as Plan A. Temporary destruction of vegetation along river edge.	Loss of 3 acres of mangroves, to be mitigated for by planting 3 acres of mangroves. Loss of some grasses and terrestrial and riverine vegetation in construction of levees and channel and filling of disposal areas.	Loss of 7 acres of mangroves.
C. Fresh Water	No impact.	Same as No-Action Plan.	Same as No-Action Plan.	Will reduce flow of fresh water from Rio de la Plata to Rio Cocal.	Same as Plan C.	Same as Plan C.	Reduced flow of fresh water from Rio de la Plata to Rio Cocal, to be mitigated for with construction of flow-control structure to pass fresh water to the Rio Cocal and a tributary.	Same as Plan C.

TABLE 9 (Cont.)
SUMMARY SYSTEM OF ACCOUNTS
(All Figures in $1,000 of May 1986)

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan E Revised	Plan F and Plan F Revised
G. Water Supply Surface Water	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
H. Ground Water	Potential for continuous salt-water intrusion. Well-recharged zones will not be impacted.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Increased localized saltwater intrusion along channel. Well-recharge not expected to be adversely impacted.	Some increase in localized saltwater intrusion but much less than under Plan E because deepening of the channel would be eliminated from design.	Same as No-Action Plan.
I. Land Use	No impact.	Levees will require 263 acres of agricultural land.	Levees will require 225 acres and the relocation of town will require 168 acres of agricultural land.	Levees will require 300 acres of agricultural lands. about 4,300 acres of land will be enhanced; only 73 acres are expected to be urbanized.	Same as Plan C. Except that 141 acres of enhanced land are expected to be urbanized.	Levees will require 367 acres of agricultural lands; 1,900 acres of agricultural lands will remain on the floodway. Approximately 6,900 acres of land will be enhanced; 1,238 acres of this area is expected to be urbanized. The rest will remain in agriculture.	Levees would require 263 acres of agricultural land; 1,436 acres of floodplain would be between the levees as a floodway; about 145 acres of semi-permanent to intermittent wetlands would be converted to upland in the disposal areas. About 695 acres of land now subject to ponding would be retained as floodwater storage areas. About 1,238 acres of land would be made suitable for urban development and about 5,011 acres would be enhanced for continued agricultural use.	Same as Plan E.

TABLE 9 (Cont.)
SUMMARY SYSTEM OF ACCOUNTS
(All Figures in $1,000 of May 1986)

	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F	Plan E Revised	Plan F Revised
II. Regional Development								
A. Income (annual)								
Regional Income	7,591	10,325	19,141	15,540	64,894	66,236	64,858	65,679
Regional Costs	1,147	4,098	4,925	1,514	2,418	1,904	1,841	2,017
Net Benefits	6,444	6,227	14,216	14,026	62,476	64,332	63,017	63,662
B. Employment								
Direct and indirect increase of jobs resulting from plan implementation (man-years)	226	218	498	491	2,187	2,252	2,206	2,238
C. Population Distribution	No impact.	Same as for Plan "A".	Provides for densification in the vicinity of the Campanillas area.	Provides for densification of the town of Toa Baja and the Campanillas area.	Provides for densification of the towns of Toa Baja and Dorado and their integration to existing developments in the area.	Same as for Plan "E".	Same as for Plan "E".	Same as fdr Plan "E".
IV. Social Well-Being								
A. Life, health, and safety of residents	Would protect about 17,000 persons.	Same as for Plan "A".	Would protect some 50,000 persons.	Same as for Plan "C".	Same as for Plan "C".	Same as for Plan "C".	Same as for Plan "C".	Same as for Plan "C".

TABLE 9 (Cont.)
SUMMARY SYSTEM OF ACCOUNTS
(All Figures in $1,000 of May 1986)

	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F	Plan E Revised	Plan F Revised
B. Social Cohesiveness	No impact.	Relocation of 369 families of the town of Toa Baja and 121 from community of Toa Villa undermine social cohesiveness of population and the role of the population of the town of Toa Baja as the principal urban center of municipality.	Relocation of 369 families of the town of Toa Baja undermine social cohesiveness of population and their role as main urban center of municipality.	Provides for integration of existing disperse developments with town of Toa Baja at eastern side of river.	Provides for integration of existing disperse developments with towns of Dorado and Toa Baja at both sides of river. Relocation of 6 dairy farms, 26 commercial and industrial establishments, 68 residences, and various public utilities.	Same as for Plan "E".	Same as for Plan "E".	Same as for Plan "E".
C. Urbanization	Does not provide for increased urbanization.	Same as for Plan "A".	Provides for limited urbanization in eastern part of river. Enhancement of 73 acres would attract about 600 additional persons to the area which would require the development of additional social and public infrastructure.	Provides for limited urbanization east of river and north and south of the town of Toa Baja. Enhancement of 141 acres would attract about 1,100 additional persons to the area, which would increase the requirements for additional social and public infrastructure.	Provides for significant urbanization of eastern and western part of river. Enhancement of 1,238 acres would attract about 10,000 additional persons to the area. Significant increase in requirements for social and public infrastructure.	Same as for Plan "E".	Same as for Plan "E".	Same as for Plan "E".
D. Reduction in Property losses (in $)	50	50	95	95	98	98	99	98
E. Residual Flooding (in $1,000 annual)	3,775	3,708	381	407	180	100	9	160

of Toa Baja. Plans E, F, and revised Plans E and F would allow for this integration in the municipality of Dorado as well as the municipality of Toa Baja.

4. Preserve Environmental and Cultural Resources. None of the proposed plans would result in significant adverse impacts, other than the loss of 5 acres of mangroves in the vicinity of Mameyal, on the study area's environmental resources. All plans will include replanting an equal acreage of mangroves. The plans suggesting ring levees (Plans A and B) would have the least effect for they would be constructed adjacent to the existing developed areas. Under Plans C, D, E, F, and revised Plans E and F, flood waters from Rio de la Plata would not enter directly into Rio Cocal system; however, the mangroves and lagoon of this area would probably continue to receive considerable amounts of water and nutrients from ground water and surface runoff from the Rio Cocal catchment area, which covers some 17.8 square miles. Also, these plans will include slide gate culverts along the levee adjacent to PR Highway to allow for fresh water from Rio de la Plata to flow into Rio Cocal.

The construction of the channel improvements under Plan E and revised Plan E will result in temporary degradition to water quality and vegetation along river edge. They are, however, expected to improve once the project is completed. Plan E revised minimizes the cutting and filling for channel improvement in order to reduce the adverse environmental impacts associated with water quality and vegetation. Revised Plan E includes gabion mattress armoring for the levee section in the vicinity of the town of Dorado and localized channel riprap to minimize erosion resulting from high velocities.

The most significant environmental impact of Plans C, D. E, and F, and revised Plans E and F would be with respect to acreage of lands needed to implement the plans and land acreage enhanced for agricultural and developmental purposes. Lands, easements, and rights-of-way for construction of levees under Plans C and D would be 378 and 413 acres, respectively, while for both Plans E and F would be about 367 acres for construction of levee and 1,900 for the floodway and channel between the levees. Plans D,E,F, and revised Plans E and F would enhance about 4,500acres of land in the eastern part of the river but only 141 acres of this land is expected to go to urban development, while the rest would be maintained or allocated for agriculture uses. On the other hand, most of the lands (1,097 acres) to be enhanced in the western part of the river under Plans E, F, and revised Plans E and F would be developed. Final land use allocation among various uses will however follow P.R. Planning Board Land use Plans and Guidelines as well as the P.R. Department of Agriculture Land Use Plans for Agriculture. Enhanced land for future development under Plans E and F and revised Plans E and F would result in annual location benefits of about $1.0 million. There would be no windfall benefits for there are a multiple owners of land including a government agency.

Another environmental impact associated with the implementation of the flood control plans relates to the destruction or increased exposure to damages of archeological sites located along the alignment of the levees, improved channels, or constrained floodway. Plans A and B would impact on one of the potential archeological sites. Plans C and D would not impact adversely on any of the sites identified. Plan F and revised Plan F may impact on 9 sites, Plan E may impact 17 sites. Revised Plan E will affect 5 known sites (refer to Section 5.07 of EIS). A cultural resources survey will be conducted to determine the significance of the potentially affected sites and access their eligibility for nomination to the National Register of Historic Places (NRHP). Attempts will be made to avoid NRHP sites. If such avoidance is not feasible, mitigation will be accomplished prior to construction.

5. Enhance Opportunities for Further Growth. Plans E, F, and revised Plans E and F contribute the most to this objective by enhancing and providing for future development about 1,239 acres of land. These plans would also allow for the urban integration of several dispersed urbanized areas in the vicinity of the towns of Toa Baja and Dorado.

6. Net National Economic Development. Plans A, B, and C do not contribute net annual national benefits while Plan D contributes $1.1 million; Plans E and F, $2.4 and 1.5 million, respectively, while revised Plans E and F contribute $3.6 and $2.3 million, respectively. The principal economic benefit resulting from the implementation of these plans would be the reduction of over $7.0 million of annual potential urban flood damages and the generation in the case of Plans E, F, and revised Plans E and F of $1.0 million of annual locations benefits. As tables D-22 and D-23 of Appendix D (Economic Analysis) show, revised Plan E maximizes and optimizes net national economic development benefits.

7. Regional Development. Regional development considers those effects on income, economic activities, income distribution, and employment generation directly or indirectly attributed to the implementation of the plans. Positive effects on regional income would result from savings on the of cost or damages associated with inundation and flood emergencies; from the expansion of the existing activities and location of new activities in the area (locational benefits); the transfer of income from other regions of the nation to buy locally produced materials, goods, and services for implementing the plans; and from the income, investment, consumption, and employment multiplier effects resulting from the initial outlays for the construction of the projects. Since OBERS projections are not available for Puerto Rico, the multiplier effect on the gross regional product was taken to be 0.77 (from the P.R. Planning Board's Econometric Model for Puerto Rico). Direct and indirect employment generation during construction was established on the basis of the experience of a similar project the Corps is currently building in the Ponce area in south Puerto Rico and by applying to the regional income potential labor/output ratios for the Puerto Rican economy. Adverse regional impacts account for the resources that the Government of Puerto Rico would contribute to the construction of the project as well as employment, the value of the economic activities, and other resources displaced by the project. Net regional annual income would range from $6.2 million under Plan B to $63.6 million under revised Plan F. Revised Plan E contributes net annual regional income of $63.0 million. Employment generation is maximized under Plans E, F, and revised Plans E and F with about 2,200 jobs.

C. Recommended Plan. On the basis of the above analysis, revised Plan E proposing channel widening and straightening from the mouth of the river to the vicinity of Toa Alta, a levee adjacent to PR Highway 165 from the coast to PR Highway 2 to protect the eastern part of the flood plain, a levee adjacent to PR Highway 693 extending from the Mameyal area to the town of Dorado and then alongside 693 from the town of Dorado to the vicinity of PR Highway 2, and several ponding areas, culverts, and a pump station to deal with interior drainage is the recommended plan. The plan will protect all areas north of PR Highway 2 against the SPF and will provide incidental 100-year level of protection to the Toa Alta/San Jose area, south of PR Highway 2. This plan maximizes national economic development, contributes substantially to regional development, minimizes adverse impacts to environmental and cultural resources, is acceptable to the residents of the area, and is consistent with local guidelines and regulations.

VIII. RECOMMENDED PLAN OF IMPROVEMENTS

A. Description of Components.

1. General. Revised Plan E, providing SPF level of protection from Río de la Plata flooding for all the developments downstream of PR Highway 2 and 100-year level of protection to the Toa Alta/San José area, is the recommended plan of improvements. This plan consists of construction of an earthern levee on the east side of the river adjacent to PR Highway 165 and another earthern levee at the west side of the river adjacent to PR Highway 193. The plan also considers channel improvement consisting of widening and straightening about 13.6 kilometers of the main river channel with a 70 meters bottom section. To deal with the interior drainage the recommended plan includes four ponding areas to provide storage to the 100-year flood, an interior collection system, six flap gate culverts to convey the 100-year runoff and a 34 cfs pump station. The plan also considers two slide gate culverts to provide fresh water discharge from Río de la Plata into Río Cocal system area during storms. To dispose unsuitable excavated materials from the channel excavation, the plan includes two upland disposal areas.

Graphic representation of the recommended plan is shown on Plate 6, typical cross sections of levee and channel, Plate 7, and typical cross sections of gabion protection for levee and riprap protection for channel, Plate 8. Detailed engineering characteristics of the recommended plan are discussed and presented in Appendix A. Details of hydraulic design data for levee are in Tables A-22 through A-35, for channel in Table A-21A, for bridges in Table A-19, and for culverts and pump stations in Table A-18A. The performance of the recommended plan is shown in Table A-36 and Plate A-10.

2. Levee Adjacent to PR Highway 165. The proposed earthern levee alongside PR Highway 165 starts south of PR Highway 2 near its intersection with PR Highway 165. From this point the levee continues in a generally westerly direction for approximately 500 meters and then takes a generally northerly direction to end at the shoreline some 800 meters from the mouth of the river. Total length of the levee is 8.4 kilometers.

From station 0+00 to station 20+00 the levee is in the vicinity of PR Highways 2 and 165. From station 37+00 to station 56+00 the levee surrounds the town of Toa Baja. The height for the proposed levee varies from 1.5 meters to 7.0 meters from ground level.

3. Levee Adjacent to PR Highway 693. The starting point for this earthern levee is located at a hill to the north and adjacent to PR Highway 2. From this point the levee continues in a generally northerly direction and ends at the shoreline some 400 meters from the mouth of the river.

The proposed levee borders the east end of the town of Dorado from station 46+00 to station 58+00. The levee is east of the Mameyal community from station 62+00 to station 73+15 near the mouth of the river. The height for this levee varies from 3.0 meters to 11.0 meters from ground level. In the vicinity of the town of Dorado, gabion mattress armoring is recommended for the levee because of potential erosion velocities due to proximity of levee to design channel.

TABLE - 10

RECOMMENDED PLAN: ELEVATIONS ALONG PROPOSED LEVEES (Meters, M.S.L.)

Levee I.D	Inlet Location	Station (Metric)	Avg. Ground Adjacent to Levee ℄	Plan "E" SPF W.S.	Plan "E" Minumim Levee Cr.
Adjacent to Hwy. 165		0+00	20.0	12.3	13.3
		2+00	7.6	12.3	13.3
		4+00	7.8	11.9	12.9
		6+00	10.8	11.6	12.6
		8+00	9.4	11.1	12.1
		10+00	9.4	11.0	12.0
		10+90	9.4	10.8	11.8
		12+00	9.2	10.7	11.7
		14+00	9.0	10.5	11.5
		15+20	9.9	10.4	11.4
		16+00	8.0	10.4	11.4
		16+50	8.0	10.3	11.3
		18+00	6.2	10.3	11.3
		20+00	8.2	10.3	11.3
		21+50	9.0	10.3	11.3
		22+00	9.2	10.3	11.3
		24+00	7.8	10.1	11.1
		24+90	7.4	10.0	11.0
		26+00	6.8	10.0	11.0
		27+90	6.0	10.0	11.0
		28+00	5.9	10.0	11.0
		29+00	5.0	10.0	11.0
		30+00	4.9	10.0	11.0
		30+70	4.8	10.0	11.0
		32+00	4.4	9.9	10.9
		34+00	4.0	9.8	10.8
		35+30	4.0	9.8	10.8
		36+00	4.4	9.8	10.8
		37+50	5.0	9.8	10.8
Town of Toa Baja		38+00	5.5	9.8	10.8
		40+00	6.0	9.8	10.8
		41+40	6.0	9.8	10.8
		42+00	5.5	9.7	10.7
		44+00	1.0	9.5	10.5
		45+90	4.0	9.4	10.4
		46+00	4.0	9.3	10.3
		47+00	1.5	9.1	10.1
		48+00	3.0	8.6	9.6

TABLE - 10 (Cont.)

RECOMMENDED PLAN: ELEVATIONS ALONG PROPOSED LEVEES (Meters, M.S.L.)

Levee I.D	Inlet Location	Station (Metric)	Avg. Ground Adjacent to Levee ℄	Plan "E"	
				SPF W.S.	Minumum Levee Cr.
Toa Baja		48+30	3.0	8.5	9.5
(IP)	6	50+00	3.5	8.2	9.2
		51+50	2.0	8.0	9.0
		52+00	2.0	7.9	8.9
(IP)	5	54+00	5.0	7.0	8.0
		56+00	4.6	6.6	7.6
		57+90	4.3	6.6	7.6
		58+00	4.3	6.6	7.6
		60+00	4.3	6.6	7.6
	25	60+10	4.3	6.6	7.6
		62+00	2.5	6.3	7.3
		62+40	3.0	6.2	7.2
		64+00	3.0	6.1	7.1
		65+50	3.0	6.1	7.1
		66+00	3.0	6.1	7.1
		68+00	1.9	6.1	7.1
		70+00	0.2	6.1	7.1
		70+80	0.2	6.0	7.0
		72+00	0.9	5.9	6.9
		72+20	0.9	5.9	6.9
	26	73+70	1.8	5.7	6.7
		74+00	1.8	5.7	6.7
		76+00	1.3	5.6	6.6
		78+00	1.2	5.5	6.5
		78+50	1.0	5.2	6.2
		80+00	1.5	5.0	6.0
		81+20	3.0	4.7	5.7
		82+00	3.0	4.4	5.4
		83+00	3.0	3.6	4.6
		84+00	4.7	2.8	3.8
Adjacent to Hwy. 693		0+00	10.3	10.7	11.7
		0+40	8.0	10.6	11.6
		2+00	7.4	10.5	11.5
		4+00	7.0	10.4	11.4
		5+50	7.0	10.3	11.3
		6+00	7.0	10.3	11.3
		8+00	7.0	10.3	11.3
		10+00	6.8	10.3	11.3
		12+00	6.8	10.2	11.2
		14+00	6.8	10.0	11.0
		16+00	6.5	10.0	11.0

TABLE - 10 (Cont.)

RECOMMENDED PLAN: ELEVATIONS ALONG PROPOSED LEVEES (Meters, M.S.L.)

Levee I.D	Inlet Location	Station (Metric)	Avg. Ground Adjacent to Levee ℄	Plan "E"	
				SPF W.S.	Minumim Levee Cr.
(IP)	24	17+00	6.2	10.0	11.0
		18+00	6.0	10.0	11.0
		20+00	6.0	10.0	11.0
		20+50	6.0	10.0	11.0
		22+00	8.0	10.0	11.0
		23+70	8.0	9.8	10.8
		24+00	6.0	9.8	10.8
		24+40	5.2	9.8	10.8
		25+00	6.0	9.8	10.8
		26+00	6.0	9.8	10.8
		28+00	6.3	9.7	10.7
		30+00	6.8	9.5	10.5
		32+00	6.1	9.2	10.2
		32+50	6.0	9.1	10.1
		33+00	6.0	8.8	9.8
		34+00	6.0	8.5	9.5
		36+00	5.0	8.3	9.3
		37+00	4.6	8.0	9.0
		38+00	4.6	7.6	8.6
		40+00	4.4	6.6	7.6
		41+00	4.4	6.6	7.6
		42+00	4.4	6.6	7.6
Town of Dorado		44+00	4.0	6.5	7.5
(IP)	8	46+00	3.4	6.1	7.1
		48+00	1.0	6.1	7.1
		50+00	1.0	6.1	7.1
		52+00	0.2	6.1	7.1
		54+00	2.9	6.0	7.0
		56+00	2.0	5.9	6.9
Community of Mameyal		58+00	1.1	5.8	6.8
		59+00	1.0	5.7	6.7
		62+00	1.0	5.5	6.5
		64+00	1.3	5.2	6.2
		66+00	1.3	5.0	6.0
		68+00	1.2	4.8	5.7
(IP)	21	70+00	1.3	4.7	5.7
		72+00	0.8	3.4	3.9
		72+70	2.0	2.9	3.9
		72+90	4.4	2.7	3.7
		73+15	8.0	2.4	3.4

4. Channel Improvements. Widening and straightening of the existing river channel is proposed from the mouth of Río de la Plata to south of the town of Toa Alta for a length of 13.6 kilometers. The bottom width will be 70 meters and the bottom elevation will vary from 4.5 meters below msl to 5.5 meters above msl. Localized channel riprap is included for those sections of the improved channel in close proximity to the levees. Three bridges will have to be replaced. These are the briges on PR Highways 693, 2, and 165.

5. Culverts and Pumps. The recommended plan also involves construction of 6 flap gate culverts (1 in the vicinity of Mameyal, 2 in the vicinity of the town of Dorado, 1 in the vicinity of Higuilar, and 2 in the vicinity of the town of Toa Baja). A 34 cfs pump station is also recommended for the town of Toa Baja. Two additional slide gate culverts along the levee section north of the town of Toa Baja are included in the recommended plan to allow for fresh water from Rio de la Plata to flow into Río Cocal and mangrove areas to the east of Río de la Plata.

6. Ponding Areas. Four ponding areas in currently vacant or agricultural lands are included in the recommended plan to hold up to the 100-year flood. These ponding areas will cover some 695 acres of land.

7. Bridges. New bridges on PR Highway 693, 2, and 165 will insure acceptable flow characteristics in terms of net velocities, flow stability, and flow depth. Minimum low chord is established to be 0.5 meters above the 100-year flood in concurrence with standards set by the Commonwealth of Puerto Rico Department of Transportation and Public Works.

8. Cut-Off Wall. The recommended plan also includes at the upper end of the channel improvement a gabion cut-off wall to ensure a stable transition from the improved channel to natural conditions.

B. Summary of Impacts. Table 11 summarizes the economics of the recommended plan of improvements for the Río de la Plata. The benefit/cost ratio for the plan is 1.6/1.0. Net national economic benefits are in the order of $3.6 million annually, which would produce directly and indirectly net regional annual income of approximately $63.0 million and about 2,200 jobs. Most of these jobs will be temporary and would be associated with the construction of housing in the enhanced lands of the study area. Over 12,000 families would be directly and permanently protected from the overflow of the Río de la Plata. Also, the proposed improvements would significantly enhance the opportunities for integration of urban settlements in the study area and for a significant expansion of additional urban development.

Direct economic costs of the proposed improvements are substantial. Total construction cost is $34.9 million, land for construction of levee and channel for rights-of-way and easements will cost $5.9 million, and relocations and alterations would require another $12.2 million. When interest during construction ($11.9 million) is added to the total first cost of the project ($34.9 + 5.9 + 12.2 = $53.0 million), total investment in the proposed works reaches $64.9 million. There would also be some significant adverse temporary economic costs associated with disruption of traffic and business as a result of replacement of three main bridges.

Details of the costs and benefits associated with the recommended plan are presented in Appendices C and D, respectively.

The recommended plan would require 265 acres for construction of levees, 435 acres for construction of channel, 1,456 acres for floodway between the levees, 695 acres for ponding areas, and 145 acres for disposal areas. A section of the Mameyal levee will result in a loss of 5 acres of mangroves. An equal acreage of mangroves will be replanted. The recommended plan would also enhance about 1,238 acres for urban development and over 5,000 acres for agricultural uses. Location of about 10,000 new families in the detailed study area will require considerable public and social infrastructure that will significantly impact the public budget for capital improvements.

The designation of the floodway between the levees and construction of the levees and channel improvement would require relocation of 68 residences, 22 commercial and industrial establishments, and 21 agricultural buildings, most of them associated with the dairy farms. There are no major relocations of public utilities.

The plan may adversely affect five identified archeological/historic sites. These five sites are located in areas of direct impact resulting from levee and channel construction. Sites located between the levees will not be subjected to new adverse effects as a result of the project. While flood water stages may be elevated at times (SPF), the duration should be reduced, thus, minimizing impacts. Similarly, velocity will be increased, but this increase will not be significantly enough to cause additional erosion.

No significant long term adverse environmental impact on the fish and wildlife, biota, vegetation, and water resources of the study area is expected to occur as the result of the implementation of the recommended plan. Details of the short and long term environmental impacts associated with the implementation of the recommended plan are presented in the Environmental Impact Statement.

Although the recommended project prevents approximately 100 percent of all damages associated with riverine flooding (See Table D-14) and prevents tidal surges from entering inland through the mouth of the Rio de la Plata, residual flooding may occur on extremely rare occasions. A 1.3 meter m.s.l. starting water surface elevation with a recurrence interval of 50 years, which was judged as a reasonable coincident tide for design conditions. Currently, unpublished studies at the University of Puerto Rico at Mayaguez for the Federal Emergency Management Agency indicate the 1.3 meter stage is about a 100 year surge. The Corps of Engineers has not conducted any design analysis to verify this coastal flooding. The predominate path of tropical storms near Puerto Rico is southeast to northwest with about one-third paralleling the north coast. There is no indication of any storm taking a southerly path making a direct hit on the north coast. The highest tide of record from 1871 to 1987 occurred near San Juan in 1964 and was 0.75 meters. Potential residual flooding and damages from hurricanes or other coastal flooding was not considered in the flood control economics analysis because of the rare probability of the hurricane surge occurring simultaneously with Rio de la Plata flooding, the added protection from storm surge gained by the levees (benefits not claimed), damages are insignificant when compared to overall benefits from riverene flooding and the questionable coastal surge data. At least annually, the local sponsor will be responsible for informing affected interests regarding the limitations of coastal flooding protection afforded by the project.

TABLE 11

RECOMMENDED PLAN: SUMMARY OF ECONOMIC IMPACTS
($1,000 May 1986)

Total First Cost	$52,965
Interest During Construction	11,885
Total Investment Cost	64,850
Total Annual Cost	5,709
Interest and Amortization(8 5/8%)	5,684
Operation and Maintenance	25
Total Annual Benefits	9,291
Inundation	7,506
Location	1,022
Others[1]	763
Net NED Benefits	3,582
Benefit Cost Ratio	1.6
Net Regional Benefits	63,017
Employment (jobs)	2,206

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[1] Includes emergency costs saved and redevelopment benefits from construction of project.

The channel excavation under the recommended plan of improvements would involve 4,580,000 cubic meters of materials, while excavation for the interior drainage canals would generate 55,000 cubic meters. Some 2,905,000 cubic meters would be used for levee fill while the rest (1,730,000 cubic meters) is unsuitable materials for levee construction that would be deposited at two currently vacant upland sites. These sites cover 145 acres of isolated wetlands with no important functions according to Section 404 guidelines.

The plan would require the replacing of Highway 693 bridge leading into the town of Dorado, Highway 2 bridge and Highway 165 bridge leading into the town of Toa Alta. The plan does not impact on the trestle bridge on the De Diego Expressway.

C. Implementation Responsibilities.

1. Federal Responsibility. The Federal Government would design and prepare detailed plans and construct the project (exclusive of those items specifically required of non-Federal interests) after Congressional authorization and funding, upon signing of a contractual agreement for local cooperation as required by Section 21 of the 1970 Flood Control Act, and upon completion of those items of local cooperation required prior to construction.

2. Non-Federal Responsibility. The non-Federal sponsor would be required to provide without cost to the United States Government all lands, easements and rights-of-way, alterations and relocations to buildings, bridges and public utilities; to hold and save the Federal Government from damages due to the construction works; and to properly maintain and operate all works after completion of the project, including establishing and enforcing regulations to assure the project effectiveness to accomplish its objectives.

3. Cost Sharing. Table 12 shows cost sharing of total first cost of the project as established in the Water Resources Development Act of 1986. The non-Federal costs would be those associated with aquisition of lands for construction of levees and channels, for rights-of-way and for easements, relocations of residential and nonresidential buildings and structures, utilities and roads, replacements of bridges and operation and maintenance. These costs would amount to about $18.0 million and represent 34 percent of the total first costs. Also, the non-Federal sponsor would have to contribute 5 percent in cash of the total first cost of the project, that is, another $2.7 million in addition to the lands, easements, and rights-of-way. The Federal contribution would therefore be $32.3 million, while that of the non-Federal would be $20.7 million.

4. Institutional Arrangements. The Department of Natural Resources (DNR) of the Government of Puerto Rico would be the sponsor and cooperating agency for the project. The DNR would organize a steering committee of representatives of the Department of Transportation and Public Works; the municipalities of Dorado, Toa Baja, and Toa Alta; the Puerto Rico Planning Board; the Puerto Rico Department of Agriculture; the Puerto Rico Envrionmental Quality Board; the Office of the Budget and Management, and representatives of residents of the study area to coordinate and program the project.

5. Steps to Plan Implementation. Submission of this report by the District Engineer constitutes the first step in a chain of events that must take place before a project can become a reality. It may be modified at any stage of review, and only if it successfully passes each stage will it ultimately be constructed. These events are:

TABLE 12

RECOMMENDED PLAN: COST SHARING OF TOTAL FIRST COSTS
($1,000 May 1986)

	Existing Policy
Total First Cost	$52,965
Non-Federal Cost:	20,623
Lands, Easements & Right-of-Ways	17,975
5% of $52,965	2,648
Federal Cost:	$32,342

a. Review of the plans and the environmental impact statements by higher Corps of Engineers authorities, including the South Atlantic Division, the Board of Engineers for Rivers and Harbors, and the Office of the Chief of Engineers.

b. At the request of the Chief of Engineers, formal review by the Governor of the Commonwealth of Puerto Rico.

c. Comment by other interested Federal agencies at the request of the Chief of Engineers.

d. Submission of the final plan and EIS and Record of Decision to the Assistant Secretary of the Army for Civil Works.

e. Review and comment by the Office of Management and Budget regarding the relationship of the project to the program of the President.

f. Submission of the plan and EIS by the Secretary of the Army to the Environmental Protection Agency.

g. Endorsement by the Secretary of the Army and submission of the report to the Congress.

h. Review and a hearing by the Public Works Committee of both Houses of Congress culminating in project authorization by the full Congress.

i. Inclusion in his budget requests, when appropriate, funds for design and construction of the authorized project by the Chief of Engineers.

j. Appropriation of the necessary funds by the Congress.

k. Fulfillment of the required measures of local cooperation.

l. Completion of the necessary surveys and investigations, preparation of plans, specifications, and an estimate of the construction cost by the District Engineer and required permits, followed by an invitation for bids and awarding of the construction contracts.

D. Coordination and Public Involvement. This report was thoroughly coordinated with the residents of the study area, the general public, the elected officials at the municipal and state levels, and the state and federal executive departments with jurisdiction in water resources development in Puerto Rico. The coordination efforts include a meeting held on April 22, 1986, with the mayors of the towns of the study area and representatives of the P. R. Planning Board, the P. R. Department of Natural Resources, the P. R. Department of Agriculture, the P. R. Envieronmental Quality Board, and the Office of the Governor to discuss plan formulation, the coordination of the draft report with 33 state and federal agencies and interested groups, and a public meeting held on January 27, 1987, with the residents of the area to discuss the draft report. Over 200 persons participated in this meeting. The consensus of all the participants in the different meetings underlines the existence of a critical flooding problem in the study area and the need for a flood control plan.

The residents of the study area, the Governor of Puerto Rico, the mayors of the municipalities of the study area, the P. R. Department of Natural

Resources (the local sponsor of the project), the P.R. Department of Agriculture, and the P.R. Planning Board have all expressed their acceptance and support of the plan recommended in this report. The residents have expressed vigorous opposition to any plan including relocalization of the town of Toa Baja. Also, some state and federal regulatory agencies have raised certain questions on the draft report and made certain suggestions to incorporate in the final report. The correspondence with all those agencies are presented in Appendix F (Coordination), while the answers to questions and comments to draft report and EIS are in the final EIS.

IX. CONCLUSIONS

The Río de la Plata Survey Investigation shows that flooding is a major problem threatening life, property, and economic development in the western sector of the San Juan Metropolitan Region, Puerto Rico. It is economically justified and considered necessary to develop and construct a flood control project along the Río de la Plata to protect the detailed study area from riverine flooding.

The plan provides for a combination of channel construction and levees to protect over 12,000 families against the SPF. Channel construction includes realignment and widening the Río de la Plata channel from its mouth to the vicinity of the town of Toa Alta, some 13.6 kilometers upstream; the construction of a levee to the east adjacent to PR Highway 165 from the coast to the vicinity of PR Highway 2; and the construction of a levee to the west adjacent to PR Highway 693 from the coast to the town of Dorado, and south to the vicinity of PR Highway 2. The plan also recommends four ponding areas, six flap gate culverts, and a pump station to deal with interior drainage problems.

I have given consideration to all significant aspects in the overall public interest, including engineering feasibility, economic, social, and environmental effects. The selected plan described in the report provides the optimum solution for flood protection along the lower reach of the Río de la Plata within the framework of the formulation concepts.

X. RECOMMENDATIONS

I recommend that the plan of improvement described in Section VIII, which consists of channel construction for flood damage reduction along the Río de la Plata and levees at both sides adjacent to PR Highways 165 and 693, be authorized for implementation as a Federal project, with such modifications as advisable at the discretion of the Chief of Engineers for a total investment cost to the United States estimated at $32,342,000 and a benefit-to-cost ratio of 1.6 to 1.0; provided that, except as otherwise stated in these recommendations, the exact amount of non-Federal contributions shall be determined by the Chief of Engineers following policies satisfactory to the President and the Congress prior to project implementation, in accordance with the following requirements to which non-Federal interests must agree prior to implementation:

a. Provide without cost to the United States all lands, easements and rights-of-way, including suitable spoil disposal areas and required diking, as determined by the Chief of Engineers necessary for construction and maintenance of the project.

b. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities, and other structures and facilities made necessary by the construction (excluding those necessary for the normal interception and disposal of local interior drainage at the line of the levees).

c. Hold and save the United States free from damages due to the construction works, not to include damages due to the fault or negligence of the United States or its contractors.

d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army.

e. Prior to initiation of construction, exact ordinances and promulgate regulations to prevent construction and encroachment on the levees and channels and other project works that would reduce their flood carrying capacity or hinder maintenance and operation, and control development in the project area to prevent an undue increase in the flood damage potential.

f. Publicize flood plain information in the areas concerned, and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to insure compatibility between future development and protection levels provided by the project.

g. At least annually, inform affected interests regarding the limitations of the protection afforded by the project.

h. The local sponsor shall comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved January 2, 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation funding.

Charles T. Myers III
CHARLES T. MYERS III
Colonel, Corps of Engineers
Commanding

[First endorsement]

CESAD-PD-P (Apr 87) (10-1-7a)
SUBJECT: Rio de La Plata, Puerto Rico - 54450

Cdr, South Atlantic Division, Corps of Engineers, 510 Title Building,
30 Pryor Street, S.W., Atlanta, Georgia 30335-6801 5 June 1987

FOR: Board of Engineers for Rivers and Harbors, Kingman Building,
Fort Belvoir, Virginia 22060-5576

I concur in the recommendation of the District Engineer.

C. E. Edgar III

C. E. EDGAR III
Brigadier General, USA
Commanding

FINAL

ENVIRONMENTAL IMPACT STATEMENT

RIO DE LA PLATA SURVEY INVESTIGATION
DORADO-TOA BAJA AREA, PUERTO RICO

The responsible lead agency is the U.S. Army Engineer District, Jacksonville, Florida.

ABSTRACT

This statement examines various plans for meeting the flooding problem in the Rio de la Plata Basin, Puerto Rico. These plans were developed in the course of a survey investigation conducted under the authority of a resolution adopted by the Committee on Public Works of the House of Representatives on May 5, 1966. The plans focused on the urbanized area of the Rio de la Plata floodplain. This area includes the towns of Dorado, Toa Baja, and Toa Alta; and the communities of Mameyal, San Antonio, and Polvorin in the Municipality of Dorado; and Levittown, Toa Ville, Ingenio, Campanillas, and San Jose in the Municipality of Toa Baja. The plans consist of combinations of channel alterations, levees, and relocations to provide flood protection. Based on thorough investigations, analyses, and predicted performance, Plan E Revised has been identified as the National Economic Development plan and the selected plan. Plan E Revised is a combination of protective levees along both sides of Rio de la Plata and the widening of the river channel from its mouth to the vicinity of the town of Toa Alta to provide protection from the Standard Project Flood from north of Highway 2 to the mouth of the channel. South of Highway 2 the channel alterations would provide protection from the 100-year flood at the Toa Alta/San Jose area.

NOTE: Information, figures, maps, and other material presented in the Rio de la Plata Survey Report Investigation and its appendices are incorporated by reference in this Environmental Impact Statement.

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ANNEX A Section 404(b) Evaluation Report

1.00 SUMMARY

1.01 Major Conclusions and Findings. This document presents an environmental analysis of alternatives developed under the authority of a resolution adopted by the Committee on Public Works of the House of Representatives on May 5, 1966, to address the flooding problems in the Rio de la Plata River basin at Toa Alta, Toa Baja, and Dorado, Puerto Rico. Eight basic alternatives were developed for detailed investigation and comparison with the base conditions. The base conditions, against which the future impacts of the alternatives are compared, is the most probable future of the area without the project. In the course of this process, a National Economic Development Plan (NED) and a selected plan were identified.

1.02 Rationale for the NED Plan. The NED Plan is the one that addresses the planning objectives and satisfies the planning criteria in a way that reasonably maximizes the net economic benefits, consistent with the Federal objectives of protecting the nation's environment pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Plan E Revised, which considers a combination of levees and channel alterations to protect against the Standard Project Flood (SPF) at the downstream, urbanized portion of the project and against the 100-year flood at Toa Alta-San Jose is designated as the NED Plan.

1.03 Rationale for the Tentatively Selected Plan. The impact-assessment process showed that Plan E Revised would best meet study objectives, particularly as they relate to the economic and human environment of the study area. This plan maximizes net national economic and regional development benefits. Implementation of the plan is not expected to significantly adversely affect the environmental resources of the area. The plan was found to be the most consistent with local interests and plans.

1.04 Section 404(b) Evaluation Report. Public Law 92-500 requires the District Engineer to evaluate the project in the light of guidelines contained in Section 404(b) of the law to determine if it is consistent with the public interest. The determinations are summarized below and the complete 404 Evaluation Report is presented in Attachment A.

a. An ecological evaluation has been made following the evaluation guidance in 40 CFR 230.4 in conjunction with the evaluation considerations in 40 CFR 230.5.

b. Appropriate measures have been identified and incorporated in the proposed plan to minimize adverse effects on the aquatic environment as a result of the discharge.

c. Consideration has been given to the need for the proposed activity, the availability of alternate sites and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law.

d. Wetlands.

(1) Dredged material. The site selected in the least environmentally damaging alternative consistent with achieving project goals, and the discharge is part of approved Federal policy for the protection and enhancement of a public resource.

(2) Fill material. The activity associated with the fill must have direct access or proximity to, or be located in, the water resources in order to fulfill its basic purpose, and the proposed fill and the activity associated with it will not cause permanent unacceptable disruption to the beneficial water quality uses of the affected aquatic ecosystem.

1.05 Coastal Zone Management Consistency. The Corps of Engineers has determined that the proposed action is consistent with the Puerto Rico Coastal Zone Management Program. This determination has been reached through consideration of information presented in this EIS and coordination with responsible Commonwealth and Federal agencies. This document was coordinated through E.O. 12372.

1.06 Areas of Controversy. No areas of controversy have been identified during the environmental review process.

1.07 Unresolved Issues. There are no unresolved issues.

1.08 Relationship of Plans to Environmental Requirements. Status of plans in relation to environmental requirements set forth in Federal and Commonwealth statutes and Executive Orders is shown in table No. 1. The nature of the proposed project is such that it has to be located on the floodplain. Several alternatives have been identified, evaluated, and discussed in this FEIS. During this process, the beneficial and adverse impacts have been discussed, and methods to minimize any adverse impacts have been determined. The views and comments of the general public in the affected area have been taken into account.

The Puerto Rico Planning Board has stated its intention of preserving most of the floodplain for agricultural purposes and there are local public policies for protecting this land from urban development. Furthermore, the Planning Board has suggested inclusion of the Puerto Rico Department of Agriculture in a project with the objective of preparing a plan for agricultural development of most of the land that will be enhanced. In addition to this, the land use regulations that the Planning Board would put into effect would serve to prevent adverse effects from poor land management.

The plan most responsive to the planning objectives established by the study and consistent with Executive Order 11988 is the selected plan. The proposed action conforms to applicable State and local floodplain protection standards, and steps have been proposed to be incorporated in the design so as to minimize potential harm to, or within, the floodplain.

2.00 NEED FOR AND OBJECTIVES OF ACTION

2.01 Study Authority. This study has been conducted under the authority of a resolution adopted by the Committee on Public Works of the House of Representatives on May 5, 1966. The resolution calls for an investigation to determine the feasibility of implementing flood-control measures to alleviate the flooding problem in the flood-prone area of Rio de la Plata.

2.02 Public Concerns. Flooding along the Rio de la Plata became a major concern after the flood of 1970 that flooded the entire town of Toa Baja with over four feet of water. Other major floods in the area have occurred in the years 1975, 1979, 1980, 1985, and 1986. The Governor of Puerto Rico and the mayors of Toa Baja and Dorado have expressed their concern for the safety of the population of their municipalities and the extensive damages that result from frequent flooding. They have urgently requested flood-control works to solve the problem.

2.03 Planning Objectives. The general goal underlying floodplain management in the study area is to guarantee the general public welfare and continuous use of the area's natural and man-made resources. Specifically, the objectives guiding this study are the following:

a. To safeguard the lives of persons living within the floodplain of Rio de la Plata.

b. To minimize potential financial and personal property losses arising from damages caused by flooding.

c. To minimize disruption of economic and social activities within the study area.

d. To revitalize the area's urban cores and to enhance opportunities for further economic development.

e. To facilitate use of existing infrastructure in the study area.

f. To preserve existing habitat of fauna at the Cienaga de San Pedro and other wetlands located east of the river and minimize any adverse environmental impacts during and after project construction.

3.00 ALTERNATIVES

3.01 Plans Considered in Detail. In addition to the no-action plan, eight basic plans were considered in detail. All these plans would offer varying degrees of flood protection. Low degrees of protection resulted in unacceptable levels of residual flooding and high potential for a catastrophic situation should the project fail. All plans considering construction of a levee adjacent to PR Highway 165 would incorporate structural features to allow fresh water from the Rio de la Plata to flow into the Rio Cocal and a tributary. Also, all structural plans investigated include a levee to protect the community of Mameyal, located to the west of the mouth of the river from riverine flooding. The alinement of the levee would be moved as close as possible to the developed area consistent with the need to maintain capability for detention of interior flooding. The alinement would result in the loss of 5 acres of mangroves. To compensate for this loss, an equal amount of mangroves would be planted east of the levee. A description of each of the plans considered is provided in the following paragraphs.

3.02 No-Action Alternative. This alternative would not provide any structural measures, thus leaving only nonstructural measures (institutional or management oriented), such as application of Planning Board Regulation 13, for controlling future development in the flood-prone area. High reliance would be placed on the current federally subsidized flood insurance program and implementation by Commonwealth and municipal civil defense offices of an effective temporary evacuation plan.

3.03 Plan A (Ring Levees and Minor Channel Diversion). This plan considered using ring levees to protect the towns of Dorado, Toa Baja, and Toa Alta and the communities of Mameyal, San Antonio, and Polvorin in the municipality of Dorado, and Toa Ville, Ingenio, Campanillas, and San Jose in the municipality of Toa Baja. In addition, the plan provides for eliminating a curve in the river immediately west of Toa Baja. The diversion channel would be 1,230 meters (1,340 yards) long with a bottom width of 20 meters (21 yards), excavated to a depth of 1.3 to 1.9 meters (1.5 to 2 yards) mean sea level with a side slope of 1 on 4. Excavation would be performed by dragline with excavated material used to backfill the eliminated meander and/or levee construction. Unsuitable material would be placed in upland disposal sites. The diversion was considered necessary to locate the river farther from the town and reduce erosional impacts on the levee.

The proposed structural measures would provide protection against the Standard Project Flood.

3.04 Non-Federal Responsibilities. Implementation of the plan would involve specific non-Federal responsibilities as follows:

a. Provide without cost to the United States all lands, easements, rights-of-way, and relocations necessary for the construction, and subsequent operation and maintenance of the project, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of excavated material and necessary retaining works.

b. Accomplish without cost to the United States all alterations and relocations of highway bridges, buildings, streets, storm drains, utilities, and other structures and improvements.

c. Hold and save the United States free from damages due to the construction works except damages due to the fault or negligence of the United States or its contractors.

d. Assume operation and maintenance of the project and project facilities.

e. Prior to initiation of construction, enact ordinances, and promulgate regulations to prevent obstruction and encroachment on the channels and other project works that would reduce their flood-carrying capacity or hinder maintenance and operation; and, control development in the project area to prevent an undue increase in the flood damage potential.

f. Publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to insure compatibility between future development and protection levels provided by the project.

g. Inform, at least annually, affected interests regarding the limitations of the protection afforded by the project.

3.05 Federal Responsibilities. The Federal Government would assume responsibilities to construct the project as described.

3.06 Plan B (Ring Levees and Relocation of the Town of Toa Baja). This plan is similar to Plan A except that it considered the relocation of the town of Toa Baja and the community of Toa Ville eliminating the need for the small channel diversion. Ring levees to protect the other affected communities were retained under this plan.

3.07 Non-Federal Responsibilities. The same responsibilities as in Plan A apply.

3.08 Federal Responsibilities. The same responsibilities as in Plan A apply.

3.09 Plan C (Hwy. 165 Levee and Relocation of the Town of Toa Baja). The main feature of this plan is a levee adjacent to Highway 165 stretching from the coast to high lands in the vicinity of Highway 2. Ring levees considered under Plan A to protect the other affected communities were retained in this plan. Relocation of the town of Toa Baja was also considered, as in Plan B.

3.10 Non-Federal Responsibilities. The same responsibilities as in Plan A apply.

3.11 Federal Responsibilities. The same responsibilities as under Plan A apply.

3.12 Plan D (Modified Hwy. 165 Levee, Ring Levees, and Minor Channel Diversion). This plan is a modification of Plan C to provide for protection of the town of Toa Baja, rather than relocate the town. Ring levees considered under Plan A to protect the other affected areas were retained under this plan, as was the diversion channel at the town of Toa Baja.

3.13 Non-Federal Responsibilities. The same responsibilities as under Plan A apply.

3.14 Federal Responsibilities. The same responsibilities as under Plan A apply.

3.15 Plan E (levees Adjacent to Hwys. 165 and 693 and Channel Alterations). This plan considered a combination of channel alterations and levees. Under this plan, the existing channel would be realined, deepened, and widened from its mouth to south of Toa Alta for about 13.6 kilometers (8 miles), with a bottom width of 50 meters (164 ft.) and side slopes of 1 on 4. The bottom elevation would vary from 6 meters (19.7 ft.) below sea level to 5.5 meters (18 ft.) above mean sea level. The channel alterations alone will provide protection against the 10-year flood.

Approximately 1,674,000 cubic meters (2,188,958 cubic yards) of excavated material would be used for levee fill. Part of the remaining excavated material could be used in backfilling river curves and meanders eliminated by channel realinement, depending on decisions to be made during the design stages. The amount of riverbed to be filled and the volume of material required would be determined during the design stage. Excess material (approximately 3,930,000 cubic meters) would be deposited in selected upland disposal sites. No evidence indicates the likelihood of contaminants being present. The number of acres required for each disposal area are:

Disposal area 1 - 60 acres
Disposal area 2 - 85 acres
Disposal area 3 - 102 acres
Disposal area 4 - 85 acres

Excavation would be accomplished by dragline and excavated material would be truck-hauled to the levee sites, to areas for backfilling, and to the nearest disposal area.

The town of Toa Alta and San Jose community would be protected by ring levees as proposed under Plan A. The east levee adjacent to Hwy. 165 is retained as considered under Plan D. An additional levee adjacent to Hwy. 693 is proposed at the west, connecting the ring levees at Mameyal and Dorado and extending to the south to high lands near Hwy. 2. The levees in conjunction with the channel alterations would protect against the Standard Project Flood.

3.16 Non-Federal Responsibilities. The same responsibilities as under Plan A apply.

3.17 Federal Responsibilities. The same responsibilities as under Plan A apply.

3.18 Plan E Revised (Channel Widening and Levees Adjacent to Highways 165 and 693. Under this plan, the existing channel would be widened to 70 meters (231 feet) from its mouth for about 13.6 kilometers (8 miles) to a point south of Toa Alta. The channel would have side slopes of 1 on 3 with a bottom elevation varying from 4.5 meters (14.8 feet) below sea level to 5.5 meters (18 feet) above sea level. The mouth of the existing channel would be moved to 100 meters to the east to avoid existing mangroves and minimize potential impacts to a prehistoric burial site. The rest of the existing channel will retain its present alinement and channel gradient to the extent possible and retain as much of the river's natural bank armoring as possible. In some areas, river meanders would be eliminated, but the resulting oxbows will remain connected to the channel. The channel alterations, without the proposed levees, would provide varying degrees of flood protection ranging from protection from the 5-year flood at Mameyal to 100-year protection at Toa Alta-San Jose.

A levee would be constructed west of the Rio La Plata from the river mouth along Highway 693 south for about 7.3 kilometers of the west floodplain. Another levee would be built to the east of the river from the river mouth along Highway 165 south for about 8.4 kilometers in the east floodplain. About 4,600,000 cubic meters of material will be excavated in channel construction. About 2,905,000 cubic meters of the material will be used in the levee construction. The remaining material, about 1,695,000 cubic meters, is considered unsuitable for levee construction and will be deposited in two disposal sites on the north and south sides of an old railroad track about 1,000 meters west-southwest of Dorado. The material will be deposited to a height of 3 meters in about 60 acres of Disposal Area 1 and about 85 acres of Disposal Area 2. The areas are depicted on plate 6 of the Main Report. The levees will range from a maximum height of 10.5 meters to a minimum of 1.5 meters with an average height of about 3.5 meters. The levee sideslopes would vary from 1 on 2.5 to 1 on 5 with a 5-meter berm and an average bottom width of 33 meters.

Levee construction on the west side of the channel downstream of the town of Dorado will remove about 5 acres of mangroves. As environmental compensation, 5 acres of mangroves will be planted in an area on the west side of the channel at the mouth near the town of Mameyal.

An estimated 55,000 cubic meters of material would be excavated behind the levees on both sides of the channel to form shallow interior drainage canals leading to culverts. Suitable material from the excavated canals would be used in levee construction with the rest deposited in the disposal areas. Flood control culverts would be provided at Toa Baja, Dorado, Mameyal, and Higuilar. As an environmental mitigation feature, two slide gated culverts would be installed at Rio Cocal and a tributary to insure fresh water flow from the Rio La Plata into the Rio Cocal. A pumping station would be constructed at Toa Baja to provide interior drainage.

The plan calls for four ponding areas for flood water storage. The ponding areas flood periodically under existing conditions and are undeveloped with scrub vegetation and grasses. Stages and duration of flooding in these areas, portions of which are used for grazing, would be less with the project than under existing conditions but land use would remain essentially the same. The ponding areas consist of a 50-acre area on the west side of the west levee at the downstream end of the project, a 631-acre area on the west side of the west levee south of the town of Dorado, a 5-acre area on the west side of the east levee opposite the 631-acre area, and a 9-acre area on the west side of the west levee at Highway 694.

About 110,000 cubic meters of riprap would be used at various points along the channel to protect against potential erosion. A gabion cut-off wall using 500 cubic meters of local rock will be constructed at the upstream end of the channel of the existing river. An additional 7,000 cubic meters of local rock will be used to construct levee gabions at Dorado, where the channel and levee are in close proximity to the town boundaries, to provide added protection against potential levee failure.

Implementation of the plan would require relocation of the bridges at Highway 165 (San Jose), Highway 693 (Dorado), and at Highway 2. In addition, the plan calls for creation of a floodway on either side of the channel within the east and west levees. Commercial, industrial, and residential structures within the floodway would be acquired and relocated. About 27 commercial and industrial structures and 42 residential structures would be involved in the 1,456 acres of floodway easement. Property located along the alinement of the levees would also require acquisition and relocation. This would involve 2 industrial and commercial structures and 26 residences in the 265 acres of the levee alinement. An estimated total of 68 families representing 272 persons would be relocated by the floodway easement and levee land acquisition.

3.19 Non-Federal Responsibilities. The same responsibilities as under Plan A apply.

3.20 Federal Responsibilities. The same responsibilities as under Plan A apply.

3.21 Plan F and Plan F Revised (Levees Hwys. 165 and 693). Plan F is the same as Plan E, except for the channel alterations. All other features of Plan E are retained. The levees would be approximately 3 meters higher than those under Plan E, which on the average would reach 4 to 5 meters from ground level. Plan F Revised is the same as Plan F but without the ring levees for the Toa Alta/San Jose area.

3.22 Non-Federal Responsibilities. The same responsibilities as under Plan A apply.

3.23 Federal Responsibilities. The same responsibilities as under Plan A apply.

3.24 National Economic Development (NED) Plan. Plan E Revised is defined as the NED Plan. Significant contributions to the planning objectives and economic efficiency, defined in terms of maximization of net benefits, consistent with the Federal objective of protecting the environment pursuant to national environmental statutes and executive orders, were the basic criteria followed in the designation of the NED Plan. Plan E Revised shows a benefit/cost ratio of 1.6. Net national economic development benefits are maximized under this plan. They amount to $3.6 million annually. Total first cost for Plan E Revised is $53.0 million. Total annual benefit is $9.3 million. Total annual cost is $5.7 million. The benefit cost ratio for the NED plan is 1.6/1.0.

3.25 Selected Plan. Plan E Revised is the recommended plan.

3.26 Comparative Impacts of Alternatives. For purposes of comparison, the impacts of future conditions without a project (no-action alternative) and the plans studied in detail are shown in table 2. Additional comparative information is included in the Main Report and Appendix D (Economic Analysis) and in the Environmental Effects Section of this statement (Section 5.00).

4.00 AFFECTED ENVIRONMENT

4.01 Environmental Conditions. The Rio de la Plata basin is the third largest drainage basin in Puerto Rico, having an area of 624 square kilometers (241 square miles).

Those areas within the Rio de la Plata basin with substantial development are the communities of Comerio, Cayey, Toa Alta, Toa Baja, Dorado, Naranjito, Aibonito, and Barranquitas.

The population of the municipalities within the basin as of 1980 was 292,387. Most of the towns mentioned above have a population ranging between 25,000 and 40,000; the exception being the town of Toa Baja with a population of 78,200. The towns of Toa Baja, Dorado, and Toa Alta are basically dormitory towns for the San Juan Metropolitan Area. They are the detailed or project study area for this study. Local economies of these communities are based on intensive agriculture, services, commerce, and government activities.

The terrain of the northern portion of the basin consists of an alluvial coastal plain. To the south, the terrain rises through an area of karst topography and finally climbs to the northern slope of the Cordillera Central and the northern and western slopes of the Sierra de Cayey.

4.02 Cultural Resources Investigations. A cultural resources reconnaissance was conducted to identify potentially significant sites that may be affected by a flood-control project in the area (Cultural Resources Reconnaissance of the Rio Cibuco, Rio de la Plata, and Rio Santiago Flood Control Projects in Puerto Rico, prepared by Karell Archaeological Services for the U.S. Army Corps of Engineers, Jacksonville District, 1985). A total of 37 sites was identified.

This work was conducted in compliance with the National Historic Preservation Act, as amended (PL 89-665); the Archeological and Historic Preservation Act, as amended (PL 95-291); and Executive Order 11593. The resulting report was coordinated with the State Historic Preservation Officer (SHPO) and the National Park Service.

Efforts were made to avoid known sites, particularly those deemed significant and/or listed on the National Register of Historic Places (NRHP). A survey would be conducted to evaluate the significance and NRHP eligibility of sites located during the reconnaisance that may be adversely affected by the project. Attempts would be made to avoid sites deemed eligible for the NRHP as a result of the survey. If such avoidance is not feasible, mitigation plans would be devised in consultation with the SHPO and the Advisory Council on Historic Preservation, and mitigation would be accomplished prior to construction.

4.03 Flora. The vegetation of the floodplain area of La Plata River has been greatly modified by man. There are perhaps some small pockets of nearly virgin forest on the karst hills, but in the floodplain itself even secondary-growth woodlands are of limited extent. Some of the floodplain acreage is actively managed for agriculture (pasture, ornamentals, and dairy farms) while vast areas have been abandoned to the growth of various species of grasses. The project area is classified as subtropical moist forest by Ewel and Whitmore (1973). However, very little forest remains.

The most important habitat type in the study area is the mangrove forest at the river's mouth, the Rio Cocal mangroves, and the Cienaga de San Pedro marsh to the east of the river. West of the river, mangroves cover about 25 acres. On the east bank, a 5-acre forest is present. Approximately 57 more acres of mangroves are located in the Mameyal sector, one mile east of the river's mouth. The Rio Cocal mangroves cover approximately 277 acres, while the adjacent freshwater marsh, Cienaga San Pedro, measures 1,038 acres. A second freshwater marsh lies south of Highway 867, covering 415 acres. On each side of the mouth of the river, outside of the mangroves and mudflats, coastal berm vegetation dominated by seagrape is found. The broad portion of the river from the Dorado bridge to just upstream of the mangroves passes through extensive grasslands.

4.04 Fauna. Various species of crabs are found in the vicinity of the mangroves and on muddy flats along the lower reaches of the river. The emergent vegetation along the edges of the river serves as cover for fish fry. High concentrations of unidentified fish larvae have been observed in the panicum grass. Unidentified species of frog have also been observed. Several valuable commercial and sport fishes are found in the river, although fish fauna is less diversified than in other areas because the highly developed sandbar does not allow for significant water exchange. Avifauna along the river vary with the habitat. The mangroves at the mouth of the river support a diversity of bird life.

Vegetation along the banks of the river is minimal and limited to herbaceous vegetation. Extended sections of the river upstream of Toa Baja show vertical eroded banks. This is due to frequent flooding and high velocities in the river channel.

Downstream from Toa Baja, the existing channel has a 40-meter width (131 feet) section and an average 3-meter-depth (9.9 feet) water level with almost vertical side slope. This section shows very few meanders and supports fishing and boating activities. The section of the river between Toa Baja and Toa Alta shows more meanders and the depth of water is less than 2 meters (2.5 feet).

4.05 Threatened or Endangered Species. The project area is located within the range of at least two federally listed endangered species. The brown pelican is likely to occur in the vicinity of the river mouth. Although the Puerto Rican boa was not observed, it may occur within the project area.

4.06 Water Supply. The basic Puerto Rico Aqueduct and Sewer Authority (PRASA) water supply unit is the individual municipality. In some cases, systems serving several municipalities have been integrated into a regional system. The study area forms part of PRASA district number 1 (San Juan Region), which encompasses the towns of Corozal, Vega Alta, Dorado, Toa Baja, Toa Alta, Naranjito, Bayamon, Catano, Guaynabo, and San Juan.

La Plata dam serves as one of the major water supply sources for the study area and the San Juan Metropolitan Area. When built in 1974, the dam provided a storage capacity of 22,100 acre-feet at the spillway crest. The addition of bascule gates, which were provided for in the design of the structure, allowed for an increase in storage of 10,600 acre-feet. The reservoir yield is about 50 million gallons a day (mgd).

There are numerous groundwater wells throughout the floodplain. They produce about 10 mgd for municipal and agriculture uses. The recharge area for these wells appears to concentrate in the karstic and lagoon areas.

Currently, PRASA is designing an aqueduct to bring some 40 mgd from Rio Manati to meet future demand for the San Juan Region.

4.07 Water Quality. Recent studies made by the Puerto Rico Environmental Quality Board (P.R. EQB) show that water quality standards for fecal coliform and dissolved oxygen have been violated in La Plata River. However, implementation of the Commonwealth program for construction of new wastewater treatment plants and control of pollution point sources could favorably affect water quality in time. Also, according to reports from the USGS, saltwater encroachment poses a problem to ground water in the study area. The saltwater wedge in the study area can reach as far as 3 miles upstream from the coast. Additional groundwater flow depletion and the storage of floodwater for relatively long periods of time in the floodplain tend to aggravate this problem.

4.08 Air Quality. According to technicians of the P.R. EQB the only nonattainment area in the island is the Catano area. The towns of Dorado and Toa Baja are attainment areas.

4.09 Noise. Since most of the study area is open space, background noise is considered typical of the countryside, except for those areas close to the towns or populated areas.

4.10 Recreation. There are numerous active and passive recreational facilities in the project area. River water-contact-oriented recreation is minimal due to the poor water quality. But there is considerable sport boating and fishing in the river, particularly during weekends. There is also a riverside park on the west bank of the Dorado River, just upstream of the Dorado Bridge, where children race remote-controlled models of boats. The study area has many attractive beaches.

5.00 ENVIRONMENTAL EFFECTS

5.01 Cultural Resources: Base Conditions and No-Action Alternative. Under base conditions and the no-action alternative, the factors affecting the condition of cultural resources in the area would remain unaltered. Sites located near the river - e.g., Ojo del Buey (D-2) - would still be exposed to erosion damage from high discharges. Similarly, sites subjected to flooding would continue to suffer the effects of erosion and recurrent inundation.

5.02 Cultural Resources: Plan A. Plan A could adversely affect one known site. This site (TB-10) is a middle- to late-19th century rural habitation area, and is located within the alinement of the proposed levee surrounding Toa Baja.

5.03 Cultural Resources: Plan B. Plan B is a modification of Plan A. However, since this plan involves relocation of Toa Baja residents, no levee would be constructed in that area. Consequently, site TB-10 would not be affected. The eastern section of the levee around Dorado could affect site D-18, a site with both prehistoric and historic material.

5.04 Cultural Resources: Plan C. The extended levee in Plan C would not affect any known sites. Thirteen (13) identified sites would be protected from future flood damages.

5.05 Cultural Resources: Plan D. Plan D would also have no effect on known sites, and would protect thirteen (13) identified sites from future flood damages.

5.06 Cultural Resources: Plan E. This plan would affect the greatest number of sites. Seventeen (17) sites are located within the proposed project area. Of these, seven (7) appear to be in areas of direct impact resulting from levee and channel construction. These include:

D-18, a prehistoric/historic site
D-10, a 19th century house
TB-7, a significant prehistoric site (Santa Elena)
TB-8, Hacienda Santa Elena, an 18th century sugar mill listed on the NRHP and HABS
D-5, a significant 18th century bridge (Puente de los Reyes)
D-24, a late 19th century truss bridge
D-19, a natural spring with prehistoric/historic material

Another three (3) sites may be affected by construction of the project. These are:

D-2, a prehistoric site with a burial
D-3, late 19th century bridge abutments
D-22, an 18th/19th century site

The remaining seven sites (listed below) are located outside of the areas that would be protected by levees, and could or could not be indirectly affected by erosion caused by project operation, for example:

D-8, a 16th/17th century site
D-11, a prehistoric/19th century site
D-9, a 16th/17th Spanish site
D-7, an 18th/19th century rural habitation site
TB-9, a 19th century hacienda main house
TB-11, a 19th century rural habitation site
TB-12, a rural habitation site

Thirteen (13) identified sites will be protected from flooding.

5.07 Cultural Resources: Plan E Revised. This plan would affect five (5) identified cultural resources located in the channel and levee alinements. These include:

D-10, a 19th century house
D-24, a late 19th century truss bridge
D-19, a natural spring with prehistoric/historic material
D-3, 19th century bridge abutments
D-22, an 18th/19th century site

Hacienda Santa Elena (TB-8), which is listed on the National Register of Historic Places (NHRP); the Santa Elena prehistoric site (TB-7), which is expected to be NRHP eligible; and Puente de los Reyes (D-5), an important historic bridge, will be avoided. None of these sites will be adversely affected, either directly or indirectly. Similarly, sites located between the levees will not be subjected to new adverse effects as a result of this project. While the stage may be elevated at times (SPF), the duration should be reduced, thus minimizing impacts. Velocity will be increased, but this increase will not be significant enough to cause additional erosion. As in Plan E, an additional thirteen (13) identified sites will be protected from flooding.

5.08 Cultural Resources: Plan F and Plan F Revised. These plans involve construction of the levees proposed in Plan E, but do not include channelization. In the case of Plan F Revised, the ring levee and the pump stations for the Toa Alta/San Jose area have been dropped because they are not economically justifiable. Two sites, D-10 and D-19, would be directly affected by levee construction. As in Plan E, seven (7) sites could be subjected to damage caused by erosion (see paragraph 5.06, above), and thirteen (13) identified sites would be protected from future flooding.

5.09 Flora (Wetlands) Base Conditions and the No-Action Alternative. If no action is undertaken, existing conditions would remain with little or no change.

5.10 Flora (Wetlands) and Plans A and B. The only significant impact to wetlands flora under these alternatives would be the loss of 5 acres of mangroves. The provisions in Plan A for a short diversion channel would result in the loss of some benthic and terrestrial invertebrates and some herbaceous riverbank vegetation.

5.11 Flora (Wetlands): Plans C and D. In addition to the destruction of 5 acres of mangroves in the vicinity of the community of Mameyal, this plan would result in a reduction in the volume of fresh water flowing from the Rio de la Plata into the Rio Cocal because of the levee adjacent to PR Hwy. 165. This could affect the mangroves and freshwater marshes located to the east of PR Hwy. 165. Three factors that could alleviate this impact are: (1) the Rio Cocal basin drains an area of about 17.8 square miles, and there are relatively large sheet flows of water moving across the agricultural lands into the wetlands; (2) a series of karstic hills located to the south are thought to provide a large percentage of the water that floods Cienaga de San Pedro through seepage of low salinity ground water; and (3) under the selected plan the levee adjacent to PR Highway 165 would include a structural feature to allow fresh water from the Rio de la Plata to flow into the Rio Cocal.

It should also be pointed out that even though Cienaga de San Pedro is included in the publication Critical Wildlife Areas of Puerto Rico (Puerto Rico DNR, 1979), the U.S. Fish and Wildlife Service has determined that it is not one of the most important wildlife areas on the island.

5.12 Flora (Wetlands): Plan E. The proposed levee alongside the community of Mameyal in Dorado would remove about 5 acres of mangroves at the mouth of the river. Five acres of mangroves would be replanted to the east of the levee to compensate for the loss. Another impact expected from the implementation of Plan E is the reduction of surface water flows to the Rio Cocal, which could adversely impact the Rio Cocal and Sabana Seca wetlands. Though relatively large volumes of surface and ground water from Cocal basin would still flow into these wetlands, a flow-control structure at the levee adjacent to PR Highway 165 would be incorporated into the final design to allow for fresh water from the Rio de la Plata to flow into the Rio Cocal and a tributary. Some loss of vegetation would result from Plan E channel alterations (typically water hyacinth, "pampano", and cana brava). However, after completion of construction, the banks of the altered channel would provide a more extensive area for the growth of similar vegetation.

5.13 Flora (Wetlands): Plan E Revised. Impacts under this plan would be similar to those under Plan E, except that less vegetation would be lost due to the plan's channel design, which will follow the existing river to the extent possible reducing most of the alterations proposed in Plan E.

5.14 Flora (Wetlands): Plan F and Plan F Revised. Impacts would be the same as under Plan E and Plan E Revised, except that those adverse and beneficial impacts associated with the channel alterations to vegetation at the river edge would not take place. On the other hand, since the levees under this plan are higher than those under Plan E, 7 acres of mangroves in the vicinity of Mameyal would be removed.

5.15 Fauna: Base Conditions and the No-Action Alternative. Under the no-action alternative, base conditions would remain with little or no change.

5.16 Fauna: Plans A and B. Since these two plans consist mainly of the construction of ring levees around populated areas, no significant adverse impact to fauna would be expected. Some terrestrial and benthic invertebrates could be covered or lost in the excavation of a short diversion channel and backfilling the eliminated curve under Plan A.

5.17 Fauna: Plans C and D. The main feature of these two plans is construction of a levee adjacent to Highway 165. No significant adverse impact would be expected from the implementation of this plan; however, fauna living alongside the highway could be temporarily frightened away by the construction activities, but similar habitats are available nearby.

5.18 Fauna: Plan E. This plan considered construction of levees along both sides of the river and alterations to the main river channel. No significant adverse impacts on fauna would be expected as a result of construction of the levees. Most of the mangroves at the river mouth would be preserved. The proposed channel alterations would affect aquatic fauna and crabs living in muddy sections of river banks as cutting and filling operations in the existing channel caused erosion, sedimentation, and siltation. To minimize this possible impact, sediment basins and sediment traps would be utilized during construction. Some benthic invertebrates would be lost in excavation and covered in backfilling eliminated portions of the riverbed, depending on decisions made during the design stages. Repopulation of the new channel and filled streambeds would occur in a relatively short period, although the riverbed fauna would be replaced by terrestrial species. Once construction was finished the fauna living alongside the river would begin to adapt to the new river channel and banks. In the long run, the channel alterations and elimination of the sandbar in the river could provide the opportunity for development of a more diversified fauna.

5.19 Fauna: Plan E Revised. Under this plan, impacts would be similar to those under Plan E but effects on aquatic fauna, crabs, and invertebrates would be considerably reduced because of reduced channel alteration and eliminating backfilling of riverbed. As in Plan E, sediment basins and traps would be utilized when needed to minimize impacts and the sandbar would be eliminated.

5.20 Fauna: Plan F and Plan F Revised. Temporary impacts of construction of levees would be similar to those under Plan E and Plan E Revised. Both adverse and positive impacts caused by the channel alterations would be avoided.

5.21 Threatened and Endangered Species: Base Conditions and No-Action Alternative. The brown pelican (*Pelecanus Occidenalis*) and the Puerto Rican boa (*Epicrates inornatus*) are the two federally listed endangered species that may be located in the project area. Under base conditions and the no-action alternative no impact would occur.

5.22 Threatened and Endangered Species: Plans A, B, C, D, E, E Revised, and F. The flood-control works would not affect pelican habitat, and additional habitat is available in nearby areas in case they could be temporarily frightened away by construction activities. Even though the Puerto Rican boa may occur within the project area, the habitat, before and after plan implementation, does not appear to be the most favorable for the species. The U.S. Fish and Wildlife Service has stated that no adverse effects on endangered species are expected.

5.23 Water Supply: Base Conditions and No-Action Alternative, Plans A, B, C, D, E, E Revised, and F. The base conditions and the no-action alternative would not have a significant effect on the present net water budget. None of the proposed plans would have significant, lasting adverse impacts on existing surface water or ground water. According to USGS personnel, saltwater intrusion currently poses a serious problem to groundwater wells in the area. The channel alterations including deepening of the existing channel considered under Plan E would extend the zone of diffusion of fresh and sea water along and under the river channel. Under Plan E Revised, this impact would be less because deepening of the channel would be eliminated. No significant impacts to the aquifer are expected. Ongoing USGS investigations suggest that the vast concentrations of fresh ground water of the Agmaman aquifer, of which the Rio de la Plata floodplain is a part, lie well below the strata from which ground water is currently obtained.

Plans E, E Revised, and F would enhance the opportunities for development of vacant lands near the towns of Dorado and Toa Baja. This would affect future water supply needs in this area. PRASA is designing an aqueduct that will transfer to the study area and the San Juan Metropolitan Area 40 mgd from Rio Manati in the central north region of Puerto Rico. This water will also serve to meet the demands of increased development in the study area.

5.24 Water Quality: Base Conditions and No-Action Alternative. Under present conditions, the no-action alternative, water quality of the La Plata River would remain unchanged.

5.25 Water Quality: Plans A, B, C, D, E, E Revised, F, and F Revised. The construction of the levees proposed under all of these plans to protect the towns of Dorado, Toa Baja, Toa Alta, and the community of San Juan would cause a temporary increase in the turbidity along the river. The relocation of the town of Toa Baja considered under Plans B and C would also increase the turbidity in the section of the river near the town. These impacts would cease when work was completed.

In order to minimize any possible adverse impact on water quality at the existing wetlands located east of the river, a flow-control structure would be incorporated into plans including E and E Revised, proposing construction of a levee adjacent to PR Highway 165 to allow waterfrom Rio de la Plata to enter the Rio Cocal system.

5.26 Water Quality: Plan E and Plan E Revised. Impacts on water quality due to the construction of the levees under Plan E would be similar to those under the other plans. The proposed channel alterations considered under Plan E would increase stream velocities in various sections of the river. This would result in additional scouring of the stream bed and, in turn, increase turbidity. Elimination of the curves in the river would remove slow-velocity areas of the stream that serve to reduce suspended sediment levels and lower turbidity. Under Plan E Revised, the proposed widening of the channel would, under conditions other than major flooding, tend to reduce velocities below existing conditions. Because Plan E Revised calls for following the existing river to the extent possible, there would be less impact on velocities than under Plan E. Plan E Revised incorporates riprap along portions of the channel and gabions along portions of the levees to stabilize the banks and reduce erosion and turbidity during major flood events when velocities are increased.

Within the next few years PRASA will be constructing the Dorado Regional Treatment Plant, which would replace the existing one and will provide enough capacity to meet future requirements expected from the new developments that would occur in some of the lands to be enhanced under Plan E and Plan E Revised.

5.27 Air Quality: Base Conditions and No-Action Alternative, Plans A, B, C, D, E, E Revised, F, and F Revised. No adverse environmental impact would occur as a result of the implementation of any of the alternatives except for some minor, temporary particulate emissions caused by construction operations. Minor adverse effects would be expected under the no-action alternative during traffic congestion caused by floods. No major effect on the airshed's quality is expected during the project life.

5.28 Noise: Base Conditions, No-Action Alternative and Plans A, B, C, D, E, E Revised, F, and F Revised. The base conditions and no-action alternative are not expected to have a significant effect on the area's noise environment. The implementation of any of the plans presented herein would result in a significant increase of noise levels during construction; however, after construction is finished, noise levels would return to normal.

5.29 Recreation: Base Conditions and the No-Action Alternative. Under these alternatives the project area's recreational resources would remain unchanged.

5.30 Recreation: Plans A, B, C, D, E, E Revised, F, and F Revised. The implementation of any of these plans would not cause adverse impacts on existing recreational resources. Under Plans E, E Revised, and F the accessibility to recreation areas and the riverside park on the west bank of the river, just upstream of Dorado bridge, would be made available through construction of ramps over the levees.

5.31 Land Use: Base Conditions and No-Action Alternative. Land subject to flooding in the floodplain amounts to 13,100 acres. Of this, 2,200 acres are already developed; 1,800 acres are mangroves and lagoons; and the rest is dedicated mainly to agriculture, either active or passive. No significant changes in land use are likely in the near future. No significant impact on land use is foreseen under the no-action alternative.

5.32 Land Use: Plans A and B. Flood protection under these plans would be limited to populated areas, thus most of the floodplain would continue to be flood prone. About 263 acres of agricultural land would be required for the construction of the ring levees. No other significant impacts on land use are foreseen under these alternatives.

5.33 Land Use: Plans C and D. Under these plans, land enhancement would be limited to the lands east of the levee adjacent to PR Highway 165. According to the PR Planning Board Land Use Policies and Plans for the San Juan Metropolitan Area, most of these lands would remain in agriculture or devoted to the preservation of environmental resources of the area. Only about 340 acres of the enhanced land would be developed for integrating and densifying existing urban settlements in the area.

5.34 Land Use: Plans E, F, and F Revised. Under these plans land use impacts east of the levee adjacent to Highway 165 would be the same as under plans C and D. Most of the lands that would be enhanced to the west of the levee adjacent to PR Highway 693 are expected to be devoted to urban development because of availability of infrastructure in the area. Future land uses in the area would follow PR Planning Board Land Use Policies and Guidelines, as well as the PR Department of Agriculture plans for the area.

The construction of the levees would require about 367 acres. The following table summarizes land use for the area under Plan E:

Floodplain area already developed	2,200 acres
Existing mangroves and lagoons	1,800 acres
Floodway area inside proposed levees	1,900 acres
Floodplain area occupied by levees	367 acres
Floodplain area enhanced for urban development	1,238 acres
Enhanced floodplain to remain for agricultural use	5,595 acres

5.35 Land Use: Plan E Revised. Impacts on land use under Plan E Revised would be similar to those under Plans E and F, but with reduced impacts in several categories and in indirect impacts. A corridor from Toa Baja east to the urbanized area west of Toa Baja would be protected under the project and subject to development. Disposal Areas 1 and 2, consisting of about 145 acres, would be available for development after placement of fill raised land elevations. A strip of land between San Antonio and P.R. Highway 693 would be protected by the project and subject to development. About 69 acres abutting the north side of Toa Baja and Areas 1 and 3 shown on plate D-2 of the Main Report are designated by the Puerto Rico Planning Board for development with or without the project.

The following table summarizes land use for the project area under Plan E Revised:

Floodplain area already developed	2,200 acres
Existing mangroves and lagoons	1,800 acres
Floodway area inside proposed levees	1,456 acres
Floodplain area covered by levees	265 acres
Floodplain area covered by channel	435 acres
Floodplain area enhanced for urban development	1,238 acres
Enhanced floodplain to remain for agricultural use	5,011 acres
Existing ponding areas to be used for floodwater storage	695 acres

In Puerto Rico, public services are centralized and Commonwealth agencies are responsible for providing, maintaining, and planning for the infrastructure and selected services needed to serve the public. The Rio de la Plata basin is expected to be developed and increase in population with or without the recommended project. However, by protecting about 1,238 acres of land available for urban uses, the project would serve to direct development of the project study area. This directed development, which would serve to concentrate urbanization in a protected area, could be regarded as a benefit.

Overall, the lands subject to potential urban settlement, which would be protected by the project, would accommodate about 10,386 families with an estimated total population of 36,351 based on settlement of 7 to 10 families per acre. From information provided by Commonwealth agencies, the infrastructure and services needed to support these families would include 520 additional school rooms, 36 more hospital beds, 108 additional police personnel, 124 kilometers of streets, 327 acres of parks, and create 1,038 new jobs. In addition, shopping areas and facilities to provide power, water, sewerage, and solid waste disposal would be required.

The Commonwealth government is aware of the strain that growth will impose on the existing infrastructure. As noted in EIS-17, the Puerto Rico Aqueduct and Sewer Authority plans to construct the Dorado Regional Treatment Plant to replace the existing plant and provide the expanded capacity to meet the needs generated by new development. Also, PRASA is designing an aqueduct to bring about 40 million gallons of water per day from the Rio Manati to add to the San Juan region water supply (See EIS-11 and Page 11 of the Main Report).

The following table (Impact Table A) presents the estimated population and infrastructure and services needs of specific parcels that would be protected for urban development.

5.36 Solid Waste: Base Conditions and No-Action Alternatives. Under these conditions increases in solid waste would occur due to urban expansion of existing communities.

5.37 Solid Waste: Plans A, B, C, D, E, E Revised, F, and F Revised. No significant impacts on solid wastes are foreseen as a result of the implementation of these plans other than those similar to those that would occur under the no-action alternative. Plan E, E Revised, F, and F Revised may result in the concentration of solid waste. This relatively insignificant impact could increase haul distances. Solid waste generated during construction would be controlled.

6.00 LIST OF PREPARERS

People primarily responsible for the preparation of this document are listed in table 3.

7.00 PUBLIC INVOLVEMENT

7.01 Public Involvement Program. Federal, Commonwealth, and local government agencies were directly involved in the study. Various plan-formulation and impact assessment meetings were held with agencies actively involved in the study effort. Coordination was established with the Office of the Governor, Office of the Resident Commissioner in Washington, D. C., and the mayors of Dorado and Toa Baja.

7.02 Required Coordination. Required coordination with Federal and Commonwealth agencies has been accomplished. Comments received in the course of that coordination resulted in the formulation of Plan E Revised, now designated as the recommended plan. Should any significant changes be made in implementing the selected plan, or new pertinent information affecting the project be developed during design studies, coordination with Federal and Commonwealth agencies will be initiated. In addition, results of the cultural resources survey to be performed as part of Plan E Revised on sites that would be adversely affected by the project would be coordinated with the State Historic Preservation Officer (SHPO). If any of these affected resources are determined to be eligible for the National Register of Historic Places (NRHP), attempts will be made to avoid them. If avoidance is not feasible, a mitigation plan will be developed in consultation with the SHPO and the Advisory Council in Historic Preservation. Any necessary mitigation would be completed before construction began.

IMPACT TABLE A
RECOMMENDED PLAN
INDIRECT SOCIO-ECONOMIC IMPACTS
ASSOCIATED WITH LAND PROTECTED
FOR FUTURE DEVELOPMENT

PARCELS

Impact	Parcel North of Dorado	Higuillar SubCenter	Parcel South of Dorado	Parcel North of Toa Baja	Parcel South of Toa Baja	Corridor Along 867	Total
Number of Protected Acres	175	72	850	42	26	73	1,238
Number of Facilities	1,468	604	7,132	352	218	612	10,386
Population	5,138	2,114	24,962	1,232	763	2,142	36,351
School (roads)	73	30	357	18	11	31	520
Hospital (beds)	5	2	25	1	1	2	36
Water (gal/day)	256,900	105,700	1,248,100	61,600	38,150	107,100	1,817,550
Power (kwh/year)	10,569,600	4,348,800	51,350,400	2,534,400	1,569,600	4,406,400	74,779,200
Streets (kms)	18	7	85	4	3	7	124
Parks (acres)	46	19	225	11	7	19	327
Sewers (gal/day)	205,520	84,560	993,480	49,290	30,520	85,680	1,454,040
Solid Waste (tons/year)	4	2	18	1	1	2	28
Automobiles	2,202	906	10,698	528	327	918	15,579
Shopping area (sq. mls)	3,409	1,403	15,564	818	506	1,421	24,121
Telephones (units)	1,468	604	7,132	352	218	612	10,386
Police (persons)	15	6	75	4	2	6	108
Property Taxes ($/yr)	3,670,000	1,510,000	17,830,000	830,000	545,000	1,530,000	25,965,000
Jobs Positions	117	[illegible]	713	35	22	61	1,038
Infrastructure Cost ($)	[illegible]	[illegible]	[illegible]	1,774,416	1,098,448	3,084,104	52,303,024

7.03 Recipients of Report.

Office of the Governor
Office of the PR Resident Commissioner in Washington
Office of the Mayor of Dorado
Office of the Mayor of Toa Baja
Office of the Mayor of Toa Alta
P.R. Department of Natural Resources
P.R. Department of Agriculture
P.R. Planning Board
P.R. Environmental Quality Board
P.R. Bureau of Budget and Management
P.R. Highway Authority
P.R. Permits and Regulations Administration
P.R. Office of the Civil Defense
P.R. Institute of Puerto Rican Culture
P.R. State Historic Preservation Officer
P.R. Municipal Services Administration
National History Society
Citizens Pro Conservation of Natural Resources
P.R. Archeological and History Foundation
U.S. Corps of Engineers, San Juan Area Office
U.S. Environmental Protection Agency, San Juan
U.S. Geological Survey, San Juan
U.S. Fish and Wildlife Service, San Juan and Atlanta
U.S. Soil Conservation Service, San Juan
Federal Highway Administration, San Juan
National Marine Fisheries Service
U.S. Coast Guard District
U.S. Environmental Protection Agency, New York
U.S. Environmental Protection Agency, Washington, D.C.
Federal Emergency Management Agency, New York
Advisory Council on Hispanic Preservation

7.04 Public Views and Responses. Coordination with Federal, Commonwealth, and local government agencies and concerns expressed by residents and representatives of industrial and commercial interests in the study area in visits to the Planning Group of the San Juan Area Office of COE, indicated that the level of property damages, threat to life and health, and general disruption caused by periodic flooding under existing conditions posed problems requiring urgent solution.

7.05 Comments and Responses to the Draft Environmental Impact Statement. Following are the comments provided to the Draft Environmental Impact Statement and responses to the comments. The individual letters are included in Appendix F, Coordination.

7.06 Comment. Plan E would adversely affect 16 historic/archeological sites, and not the 14 identified in the DEIS (State Historic Preservation Officer).

Response. After mapping the sites identified during the reconnaissance, it appears that seven (7) sites would be directly affected by construction of the levees and channel specified in Plan E. An additional three (3) sites could be affected by construction, and seven (7) other sites located outside the areas protected by levees could or could not be subjected to new adverse effects (such as increased erosion) as a result of the project operation. A total of 17 sites could be affected by Plan E. These impacts are discussed in paragraph 5.06.

7.07 Comment. Plan F would affect only three (3) cultural resources and is preferred over the selected Plan E (State Historic Preservation Officer).

Response. A review of the sites identified revealed that only two (2) known sites would be directly affected by construction of the levees for Plan F. As in Plan E, however, an additional seven (7) sites could experience adverse effects from erosion. These impacts are discussed in paragraph 5.07 and 5.06. Plan E is the selected plan because it maximizes the Net National Economic and Regional Development benefits.

7.08 Comment. Plan E would affect three (3) known significant sites, including one (Hacienda Santa Elena) that is eligible for listing in the National Register of Historic Places (NRHP). Other sites affected by Plan E have not been adequately studied, but include resources with unknown research potential. (State Historic Preservation Officer).

Response. Given the number of cultural resources located during the reconnaissance study, a survey of the project area for the selected plan will be conducted to (1) identify/locate additional sites and (2) evaluate the significance and NRHP eligibility of any sites that may be adversely affected by the project. Attempts will be made to avoid NRHP sites. If such avoidance is not feasible, a mitigation plan for adversely affected sites will be devised in consultation with the State Historic Preservation Officer, and mitigation will be accomplished prior to construction.

7.09 Comment. "The location of all temporary staging areas, stockpiling areas, haul roads, highway reroutings, borrow areas and related earthmoving and construction activities should be considered from the outset to assure that they would not be placed in or near known cultural resources." (Puerto Rico State Historic Preservation Officer).

Response. These areas will be considered during the survey as discussed in paragraph 7.08.

7.10 Comment. The feasibility of moving the levee in front of Toa Baja to the west to avoid a possible stranglement in this area should be investigated. (Trigo Corporation).

Response. The alinement of the levee as shown on the feasibility plan was designed to follow the alinement of PR Highway 693 so as to avoid the relocation of this highway. The floodway between the two levees, combined with the channel alterations and the pumping station to be located nearby, would have the needed hydraulic capacity to handle the design flood flows in this area.

7.11 Comment. A recommendation is made to evaluate the engineering and economic feasibility of relocating the portion of the levee east of the river and north of Toa Baja, to avoid the need to relocate the property of Trigo Corporation. (Trigo Corporation).

Response. This recommendation would be considered during the design stage.

7.12 Comment. There is a need to reexamine the design of Plan E to provide an adequate access to the lands that would remain within the levees to allow their use for grazing by local dairy farms. (P.R. Department of Agriculture).

Response. On page 25, the Main Report states that the lands that would remain as part of the floodway could be used for pasture and grazing most of the time. Adequate access would be incorporated into the final design of the project to allow for this usage.

7.13 Comment. Proposed uses for lands to be enhanced by the project should be consistent with the objectives and public policies of the Puerto Rico Planning Board set forth in the Land Use Plan for Puerto Rico. (P.R. Department of Agriculture).

Response. As stated in paragraph 5.31, future land uses in the area would follow P.R. Planning Board Land Use Plan policies and guidelines as well as the P.R. Department of Agriculture plans for the area.

7.14 Comment. On the disposition of dredged material, all necessary measures should be taken to minimize the impacts on the lands with high agricultural potential in the area. (P.R. Department of Agriculture).

Response. The selection of disposal areas would be coordinated with the Commonwealth Government and care would be exercised to minimize the impacts on existing or potential agricultural lands.

7.15 Comment. There is a need to address the impacts of the channel improvements considered in the recommended plan on stream velocities and turbidity. (U.S. Environmental Protection Agency, P.R. Department of Natural Resources).

Response. These impacts are discussed in paragraph 5.23. Also, see Table 2, Comparative Impacts of Alternatives, for discussion of turbidity effects on water quality for Plan E. Additionally, we agree with the U. S. Fish and Wildlife Service that there will be no adverse effects on the manatee or on the manatee habitat.

7.16 Comment. There is a need to discuss the impacts of the channel improvements considered under the selected plan on the groundwater resources of the area and on the location of the salt wedge. (U.S. Environmental Protection Agency, P.R. Department of Natural Resources).

Response. These impacts are discussed in paragraph 5.20.

7.17 Comment. There is a need to discuss in greater detail the method of disposal for the dredged material if the presence of contaminants have been determined, and if the river segments isolated by the channel improvements would be backfilled. (U.S. Environmental Protection Agency).

Response. These items are discussed in paragraphs 1.04, 3.03, 3.15, and 5.16.

7.18 Comment. There is a need to incorporate a flow-control structure on the levee adjacent to P.R. Highway 165 to allow the flow of fresh water to the Rio Cocal mangroves and the Cienaga de San Pedro. (U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service).

Response. This structure will be incorporated into the final design of the project.

7.19 Comment. There is a need for a detailed analysis of the impacts of the plans on the Rio Cocal, the Rio Cocal mangroves, and the Cienaga de San Pedro. (U.S. Environmental Protection Agency).

Response. The impacts to these systems are discussed in paragraphs 5.11, 5.22, and 5.23.

7.20 Comment. There is a need to identify secondary environmental impacts that would result from measures that protect the western floodplain of Rio de la Plata. (U.S. Environmental Protection Agency).

Response. Secondary impacts are discussed in paragraphs 5.20, 5.23, and 5.31.

7.21 Comment. A recommendation is made to move the levee near the community of Mameyal as close as possible to the community to avoid cutting through the mangrove forest at the river's mouth. (U.S. Fish and Wildlife Service).

Response. The levee east of Mameyal Community was alined as close as possible to the community to maximize the hydraulic efficiency of the levees and to minimize the impacts on the mangrove area nearby. The extent of this impact and mitigation measures to be implemented are discussed in paragraphs 5.11 and 5.12.

7.22 Comment. There is a need to address the indirect effect of the channel alterations on the mangroves near the river's mouth. (U.S. Fish and Wildlife Service).

Response. These effects are discussed in paragraph 5.11.

7.23 Comment. There is a need to compare the cost of dredging and channel maintenance with the cost of levee maintenance as part of the benefit/cost analysis. (P.R. Department of Natural Resources).

Response. These costs are included in the overall benefit/cost analysis for the project.

TABLE 1
RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION REQUIREMENT STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENTS

Federal Statutes	No-Action Alternative	PLAN A Ring Levees	PLAN B Ring Levees and Reloc. of Toa Baja	PLAN C Highway 165 Levee	PLAN D Hyw 165 Levee and Reloc. of Toa Baja	PLAN E Levees & Channel	PLAN E REVISED	PLAN F AND PLAN F REVISED Levees Without Channel
Archaeological and Historic Preservation Act, As amended, 16 U.S.C. 469, et seq.	F	C	C	C	C	C	C	C
Clean Air Act, as amended, 42 U.S.C. 7401, et seq.	F	F	F	F	F	F	F	F
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.	F	F	F	F	F	F	F	F
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq.	F	F	F	F	F	F	F	F
Endangered Species Act, as amended, 16 U.S.C. 1531 et seq.	F	F	F	F	F	F	F	F
Estuary Protection Act, 16 U.S.C. 1221, et seq.	F	F	F	F	F	F	F	F
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq.	F	F	F	F	F	F	F	F

Legend:
F = full compliance
P = partial compliance
C = compliance prior to construction
N = non compliance
N/A = not applicable

TABLE 1 (Cont)
RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION REQUIREMENT STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENTS

Federal Statutes	No-Action Alternative	PLAN A	PLAN B	PLAN C	PLAN D	PLAN E	PLAN E REVISED	PLAN F AND PLAN F REVISED
Fish and Wildlife Coordination Act, as amended, U.S.C. 661, *et seq.*	F	F	F	F	F	F	F	F
Land and Water Conservation Fund Act, as amended, 16 U.S.C. 4601-4601-11, *et seq.*	F	F	F	F	F	F	F	F
National Historic Preservation Act, as amended	F	C	C	C	C	C	C	C
National Environmental Policy Act, as amended, 42 U.S.C. 4321, *et seq.*	F	F	F	F	F	F	F	F
Rivers and Harbors Act 33, U.S.C. 401, *et seq.*	N/A	F	F	F	F	F	F	F
Watershed Protection and Flood Prevention Act, 16 U.S.C. 101, *et seq.*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, *et seq.*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Legend:
F = full compliance
P = partial compliance
C = compliance prior to construction
N = non compliance
N/A = not applicable

TABLE 1 (Cont)
RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION REQUIREMENT STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENTS

Federal Statutes	No-Action Alternative	PLAN A	PLAN B	PLAN C	PLAN D	PLAN E	PLAN E REVISED	PLAN F AND PLAN F REVISED
Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.	F	F	F	F	F	F	F	F
Executive Orders Memoranda, etc.								
Flood Plain Management (E.O.11988)	F	F	F	F	F	F	F	F
Protection of Wetlands (E.O. 11990)	F	F	F	F	F	F	F	i
Environmental Effects Abroad of Major Federal Action (E.O. 12114)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum, 30 Aug 76)	F	F	F	F	F	F	F	F
COMMONWEALTH OF PUERTO RICO STATUTES								
Environmental Public Policy Act 12 LPRA 1121, et seq.	F	F	F	F	F	F	F	F
Planning Board Organic Act, 23 LPRA 22, et seq.	F	F	F	F	F	F	F	F
Forestry Act, 12 LPRA 193, et seq.	F	F	F	F	F	F	F	F
Water Law, 12 LPRA 1502, et seq.	F	F	F	F	F	F	F	F
Department of Sports and Recreation Organic Act Law 126 of 13 June 1980	F	F	F	F	F	F	F	F
Mangrove Protection Policy Resolution 74-21 of 9 Oct 74	F	F	F	F	F	F	F	F

Legend:
F = full compliance; P = partial compliance; C = compliance prior to construction; N = non compliance;
N/A = not applicable

TABLE 1 (Cont)
RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION REQUIREMENT STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENTS

Commonwealth Statutes	No-Action Alternative	PLAN A	PLAN B	PLAN C	PLAN D	PLAN E	PLAN E REVISED	PLAN F AND PLAN F REVISED
Permits:								
Water Quality Certification EQB Regulation	F	C	C	C	C	C	C	C
Fugitive Dust EQB Regulation	F	C	C	C	C	C	C	C
Noise EQB Regulation	F	F	F	F	F	F	F	F
Solid Waste Disposal EQB Regulation	F	C	C	C	C	C	C	C
Earthwork, 28 LPRA 206, et seq. DNR Regulation	F	F	F	F	F	F	F	F
Construction in Floodable Areas, Planning Board Regulation 13	F	F	F	F	F	F	F	F
Erosion and Sedimentation EQB Regulation	F	C	C	C	C	C	C	C

Legend:
F = full compliance
P = partial compliance
C = compliance prior to construction
N = non compliance
N/A = not applicable

TABLE 2

COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative (Without Project Conditions)	Ring Levees Plan A	Ring Levees and Reloc. of Toa Baja Plan B	PR Hwy 165 Levees Plan C	PR Hwy 165 Levees and Reloc. of Toa Baja Plan D	Levees and Channel Plan E	Plan E Revised	Levees Without Channel Plan F and Plan F Revised
ultural Resources	37 identified sites will remain subject to flooding and erosion.	Toa Baja levee may adversely affect one site.	Levee around Dorado may adversely affect one site.	No adverse effects. Thirteen (13) identified sites will be protected from future flood damages.	Same as Plan C.	Levee and channel construction will affect 7 sites and may affect an additional 3 sites. Another 7 sites may be indirectly affected by increased erosion. Thirteen (13) identified sites will be protected from flooding.	Levee and channel construction would affect 3 sites. Thirteen sites will be protected from periodic flooding.	Levee construction will affect 2 sites. As in Plan E, another 7 sites may be subjected to erosion damage, and 13 will be protected from future flooding.
Flora Wetlands	No impact.	Loss of 5 acres of mangroves. Loss of some grasses and terrestrial vegetation in construction of diversion channel and some riverine vegetation in backfilling eliminated meander.	Same as Plan A, except impacts associated with diversion channel are eliminated.	Same as Plan B.	Same as Plan A.	Same as Plan A. Temporary destruction of vegetation along river edge.	Loss of 5 acres of mangroves, to be mitigated for by planting 5 acres of mangroves. Loss of some grasses and terrestrial and riverine vegetation in construction of levees and channel and filling of disposal areas.	Loss of 7 acres of mangroves.
Fresh Water	No impact.	Same as No-Action Plan.	Same as No-Action Plan.	Will reduce flow of fresh water from Rio de la Plata to Rio Cocal.	Same as Plan C.	Same as Plan C.	Reduced flow of fresh water from Rio de la Plata to Rio Cocal, to be mitigated for with construction of flow-control structure to pass fresh water to the Rio Cocal and a tributary.	Same as Plan C.

TABLE 2 (Continued)
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan E Revised	Plan F and Plan F Revised
Fauna								
Avian and Fisheries	No Impact.	Construction of the diversion channel and the levees and back-filling the eliminated river curve would result in the loss of some benthic and terrestrial invertebrates and in temporary disturbance to fauna.	Same as No-Action Plan	Temporary disruption of land fauna due to construction of levees.	Same as Plan C and Plan A.	Same as Plan C. Disruption and partial destruction of aquatic fauna and fisheries because of channel construction and backfilling. The removal of sandbars may induce diversification of aquatic fauna.	Temporary disruption of fauna due to construction of levees and channel and filling disposal areas. Loss of some benethic and terrestrial invertebrates to construction and disposal activities.	Same as Plan C
Federal Threatened and Endangered Species	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.
Water Quality	Continued erosion, turbidity and sedimentation.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action plan, but with more turbidity during construction. Reduced flow of fresh water to Rio Cocoal from Rio de la Plata.	Same as Plan C.	Increased erosion and turbidity during construction. Turbidity in the channel could be higher than under existing conditions due to increase in velocities. However, overbank velocities and turbidity during flooding conditions would be considerable lower than under existing conditions.	Same as Plan E, except that widening the channel would tend to reduce turbidities during normal flow conditions. As in Plan E, turbidity during flood events would be reduced from existing conditions.	Same as Plan C

TABLE 2 (Continued)
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan E Revised	Plan F and Plan F Revised
Water Supply Surface Water	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Ground Water	Potential for continuous salt-water intrusion. Well-recharged zones will not be impacted.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Increased localized saltwater instrusion along channel. Well-recharge not expected to be adversely impacted.	Same increase in localized saltwater intrusion but much less than under Plan E because deepening of the channel would be eliminated from design.	Same as No-Action Plan.
Land Use	No impact.	Levees will require 263 acres of agricultural land.	Levees will require 225 acres and the relocation of town will require 168 acres of agricultural land.	Levees will require 300 acres of agri-cultural lands. about 4,500 acres of land will be enhanced; only 73 acres are expected to be urbanized.	Same as Plan C. Except that 141 acres of enhanced land are expected to be urbanized.	Levees will require 367 acres of agricultural lands; 1,900 acres of agricultural lands will remain on the floodway. About 6,900 acres of land will be enhanced; 1,238 acres of this area is expected to be urbanized. The rest will remain in agriculture.	Levees would require 265 acres of agricultural land; 1,456 acres of floodplain would be between the levees as a floodway; about 145 acres of semi-permanent to intermittent wetlands would be converted to upland in the disposal areas. About 695 acres of land now subject to ponding would be retained as floodwater storage areas. About 1,238 acres of land would be protected for urban development and about 5,011 acres would be enhanced for continued agricultural use.	Same as Plan E.

TABLE 2 (Continued)
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan E Revised	Plan F and Plan F Revised
Noise	No Impact.	Temporary noise insrease during construction.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as Plan A.	Same as for Plan A.
Air Quality	No Impact.	Some minor adverse effects during construction.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as Plan A.	Same as for Plan A.
Solid Waste	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.	No Impact.
Transportation	Disruption of traffic during floods.	Same as No-Action Plan.	Same as No-Action Plan	Enhanced opportunity for providing adequate road system.	Same as for Plan C.	Same as for Plan C.	Same as for Plan C.	Same as for Plan C.
Economics ($ million) Total Investment Cost	N/A	56.7	112.8	136.2	77.6	72.1	64.9	90.3 80.2
Annual Cost	N/A	5.1	10.0	12.1	6.9	6.4	5.7	8.0 7.1
Annual Benefits	N/A	4.4	4.4	8.7	8.1	8.8	9.3	9.5 9.4
B/C Ratio	N/A	1.0/1.0	0.4/1.0	0.7/1.0	1.2/1.0	1.4/1.0	1.6/1.0	1.2/1.0 1.3/1.0

TABLE 3
LIST OF PREPARERS

Name	Discipline/Expertise	Experience	Role in Preparing
Dr. Emilio Colon	Engineering/Civil Environmental	2 years water resources consultant, 2 years natural resources planning, P.R. Department of Natural Resources, 10 years water resources planning, Jacksonville District	Study Manager Formulation of Alternatives Assessment of Impacts
Mr. Jose A. Martinez	Economics	3 years water resources Planning, P.R. Department of Natural Resources, 11 years economics, Jacksonville District	Formulation of Alternatives, Assessment of Impacts
Dr. Rona Mazer	Anthropology	5 years assistant professor, 3 years anthropologist Jacksonville District	Cultural Resources Impact Assessment.
Ms. Lillian Vega	Economics	13 years water resources planning economics, Jacksonville District 13 years.	Formulation of Alternatives. Assessment of Impacts.
Mr. Carmelo Caez	Engineering/Hydrologist	EIS studies and consulting, 12 years private firm, and 1 year Jacksonville District	Assessment of Impacts Affected Environment.

TABLE 3 (Cont.)
LIST OF PREPARERS

Name	Discipline/Expertise	Experience	Role in Preparing EIS
Mr. Juan Marroig	Engineering/Hydrologist	8 years hydraulic engineering with Jacksonville District	Assessment of Impacts Affected Environment.
Mr. Mark Wren	Technical Writer/Editor	17 Years EIS studies Jacksonville District	Editing EIS
Mr. Robert Pace	Biology	2 years biology consultant, 1 year biological technician, National Marine Fisheries Service, 2 years biologist, Jacksonville District, 6 years with Fish and Wildlife Service.	Environmental Impact Assessment

ANNEX A

SECTION 404(b) EVALUATION REPORT
RIO DE LA PLATA SURVEY INVESTIGATION
TOA BAJA-DORADO, PUERTO RICO

1. PROJECT DESCRIPTION

a. Location. The project is located in the Toa Alta, Toa Baja, and Dorado area of Puerto Rico in the Rio de la Plata basin. The Rio de la Plata coastal floodplain is about 18 kilometers (11 miles) west of San Juan, Puerto Rico.

b. General Description. The project consists of a study of flooding and related land resources problems in the coastal floodplain of Rio de la Plata to develop a plan for solving the problems. The study recommends construction of levees on both sides of the river in conjunction with channel construction to convey the Standard Project Flood. The channel construction would involve widening, some realinement, and some bank stabilization to provide in-bank capacity ranging from the 5-year flood at the downstream end of the project to 100-year flood protection at the upstream end. The floodplain levees would provide the additional protection to the Standard Project Flood level.

c. Authority and Purpose. The project is authorized under a resolution adopted on May 5, 1966, by the Committee on Public Works of the U.S. House of Representatives.

d. General Description of Dredged and Fill Materials.

(1) The material to be excavated and used for fill consists of peat, clay, silt, sand, gravel, weathered siltstone, and weathered limestone. An additional 117,000 cubic meters (153,689 cubic yards) of rock from local quarries will be used for riprap and gabion construction.

(2) Quantity of material proposed for discharge is about 4.6 million cubic meters (7,324,800 cubic yards) from excavation for channel construction and 55,000 cubic meters (71,940 cubic yards) from excavation for interior drainage canals. About 2,905,000 cubic meters (3,799,740 cubic yards) from channel excavation and an unquantified portion of the material from drainage canal excavation will be used in levee construction. The remaining material, in excess of 1,695,000 cubic meters (2,217,060 cubic yards) expected to be unsuitable for levee construction will be placed in two disposal sites consisting of isolated wetlands. About 117,500 cubic meters (153,689 cubic yards) of riprap and rock will be placed at various points along the channel to protect against potential erosion.

e. Description of the Proposed Site.

(1) Location: The levee discharge sites consist of a 7.3 kilometer (4.5 miles) levee west of the channel along Highway 693 south from the river mouth and a levee east of the channel along Highway 165 from the river mouth

south for 8.4 kilometers (5.2 miles). The disposal sites that would receive excavated material are located on the north and south sides of an old railroad track about 1,000 meters (3,280 feet) west-southwest of Dorado. (See plate 6 of the Main Report.) Riprap and gabion rock would be placed at various points along the channel banks including at the town of Dorado and at the upstream end of the project.

(2) Size: The completed levees would cover an estimated 265 acres (9.5 hectares). Disposal Area 1, when filled to a height of 3 meters (9.8 feet), would cover about 60 acres (2.1 hectares). Disposal Area 2, filled to the same height, would cover about 85 acres (3 hectares).

(3) Type of sites and habitats: For the most part, the levee sites are covered with scrub vegetation and grasses typical of the La Plata floodplain. Near the mouth of the Rio de la Plata is a 25-acre (10 hectares) stand of mangroves 5 acres of which would be covered during levee construction. Because they are flooded only occasionally, the mangroves do not perform important wetlands functions such as detrital export to estuaries, groundwater recharge, or provide important habitat. The area has been degraded by illegal dumping of trash from nearby developments. Disposal Areas 1 and 2 are isolated wetlands. Disposal Area 1 is palustrine, emergent, temporary to semi-permanent wetland. Disposal Area 2 is of the same vegetation classification but is a temporary or intermittent wetland. Neither of the areas have important wetland functions defined by Section 404 guidelines. The riprap and gabion stone will be placed along portions of the river bank and portions of the levees consisting of sand and gravel with no significant habitat value.

(4) Timing and duration of discharge: To be determined on completion of detailed design.

f. Description of Disposal Method. Material would be excavated by dragline and backhoe and would be transported to the proposed site by truck for discharge.

2. FACTUAL DETERMINATIONS

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope: Substrate at the discharge sites are at ground level with elevations varying around 5 meters (16.5 feet) mean sea level with a slight slope toward the Rio de la Plata.

(2) Sediment Type: Sediment types at the discharge sites include sand and sandy and silty clay.

(3) Fill Material Movement: The material discharged along the levee alignments will be compacted and shaped to form the levees. In view of the average height of the levees (3.5 meters or 8.0 feet) and the sideslopes (1 on 2.5 to 1 on 5) and the expected quick colonization of the levees by native vegetation, no significant fill material movement is anticipated.

In the disposal areas the existing ground elevations (about 2.5 meters (8.2 feet) mean sea level) will be changed as the discharged material will be deposited to a height of 3 meters (9.9 feet) raising existing elevations to about 5.5 meters (18 feet) with sideslopes of 1 on 4 and relatively rapid colonization by sedges and grasses, no significant fill material movement is expected. Fill material used in gabions will be stabilized by the gabion framework. The riprap stones will be of sufficient weight to minimize any effect from river flow and will remain largely in place.

(4) Physical Effects on Benthos: Construction of levees will preclude out migration of mobile benthic organisms. An unquantified number of benthic organisms will be covered by levee construction, placement of riprap and gabions, and at Disposal Areas 1 and 2. Some benthic organisms capable of upward burrowing may survive. The change in elevation at the levee and disposal areas eventually will affect species types and diversity. The semi-permanent and intermittent wetlands character of the disposal areas will be altered to an upland character resulting in colonization by vegetation and animals typical of upland habitats. The disposal areas are located within an area designated for development by the Puerto Rico Planning Board and eventually may become urbanized.

b. Water Circulation, Fluctuation, and Salinity Determinations. There would be no significant effects.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels at the discharge sites. Construction of the levees would cause a temporary increase in turbidity with no lasting significant effects. Placement of riprap and installation of gabions would have similar impacts.

(2) Effects on chemical and physical properties of the water column: There will be no significant effects on light penetration, dissolved oxygen, or esthetics as far as the water column is concerned. No toxic metals, organics, or pathogens will be introduced into the water column.

(3) Effects on biota

(a) Primary productivity and photosynthesis: Placement of fill will result in the loss of about 5 acres of mangroves, with resulting small-scale losses of productivity.

(b) Wildlife and Aquatic Species: The discharge sites are surrounded by urban development, and are used for illegal dumping of trash. This discourages development of significant wildlife populations. There are no significant aquatic species present.

d. Contaminant Determinations: There will be no introduction, increase, or relocation of contaminants to the discharge sites.

e. Aquatic Ecosystem or Organism Determinations: The fill materials meet the exclusion criteria. Therefore, no further chemical/biological interactive testing is required.

(1) Effects on Sanctuaries, Refuges, Wetlands, or Vegetated Shallows: No sanctuaries, refuges, or vegetated shallows are present.

(2) Threatened and Endangered Species: There would be no significant effect on listed species.

(3) Other Wildlife: Sec 2C(3)(b). Some benthic invertebrates, terrestrial organisms, and invertebrates unable to burrow through the fill material would be lost.

f. Proposed Disposal Site Determinations.

(1) Determination of compliance with applicable water quality standards: The discharge of fill material will not violate Commonwealth water quality standards.

(2) Potential Effects on Human Use Characteristics: There will be no effect on municipal or private water supplies or on recreational or commercial fisheries or water-related recreation. Esthetics would be temporarily affected by the construction activity. There are no parks, national or historical monuments, national seashores, wilderness areas, research sites, or similar preserves in the area of discharge.

g. Determination of Cumulative Impacts on the Aquatic Ecosystem. The proposed discharge will have no cumulative impacts that would impair water resources or significantly affect the productivity and water quality of the existing aquatic ecosystem.

3. FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. The discharge of fill materials will not cause or contribute to, after consideration of disposal site dilution and dispersion, violations of any applicable Commonwealth water quality standards for Class III waters. The discharge operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

c. The placement of fill materials will not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended.

d. The placement of fill materials will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic species and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability, and recreational, esthetic, and economic values are not expected.

e. On the basis of the guidelines, the proposed disposal sites for the discharge of fill materials are specified as complying with requirements of the Section 404(b)(1) guidelines.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Caribbean Field Office
Box 491
Boquerón, Puerto Rico 00622

February 25, 1986

Dr. Emilio M. Colón
Chief, Planning Group
U.S. Army Corps of Engineers
400 Fernández Juncos Ave.
San Juan, Puerto Rico 00901

Dear Emilio:

We have reviewed your proposal for flood protection at Río de la Plata. You have solicited FWS comments regarding the raising of Highway 165 from the De Diego Expressway to the el Mameyal sand dune to act as a levee. Apparently, you had previously considered construction of ring levees around Toa Baja, Ingenio, and Campanillas communities. We did not have information regarding proposed flood control structures when we completed our resource report on October 31, 1983, and we did not then include the Río Cocal mangroves or San Pedro marsh in our study area. This letter is a suppliment to that report; our comments are issued in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The proposed levee would not result in any direct destruction of important wildlife habitats, however, you are correct in suggesting that it will probably reduce flow of fresh water to the mangroves and fresh water marshes located to the east, in Sabana Seca Ward, Municipality of Toa Baja. We have calculated that the Mameyal mangrove covers a total area of about 23 hectares (57 acres). The Río Cocal mangroves cover approximately 112 hectares (277 acres), while the adjacent fresh water marsh, Ciénaga San Pedro, measures 420 hectares (1038 acres). A second fresh water marsh lies south of Highway 867, covering 168 hectares (415 acres). Ciénaga San Pedro and the Río Cocal mangroves would be the most affected by the project.

The only streams bringing fresh water into the wetlands from west to east are Río Cocal and Caño Campanero. The proposed plan appears not to effect Caño Campanero, but would isolate Río Cocal from its source of water, Río de la Plata. Sheet flow of water across the agricultural lands into the wetlands is probably an important inflow during floods, although the extent to which the present road bed contains flood water must be considered. Urban development and the channelization of the Río Bayamón have limits inflow of fresh water from the east. To the south, there is a series of karstic hills which are quite permeable to water. We think that a large percentage of the water flooding Ciénaga San Pedro is seepage of low-salinity groundwater through these hills. Figures 1 and 2 show that water hardness and chloride concentration of groundwater in the unconfined aquifer are lower in the vicinity of the Sabana Seca and Cucharillas wetlands (Anderson, 1976). This implies an input of less saline groundwater. Figure 3 shows an elevated water table in the Candelaria area, which could drive the percolation of water through the limestone to the Sabana Seca marshes and mangrove forests, where the water table is at or above the ground surface (Torres-González and Díaz, 1984). We therefore think that isolating these wetlands from Río La Plata will not dry them out, however periodic pulses of surface flows of fresh water during heavy rainfall will be greatly reduced.

With present information, we can only make generalizations about the effects of this project on the wetland vegetation. Retention of water within the levee will reduce water depth and the length of time surface water is present in the wetlands. The extent of change in vegetation could be predicted, but this would require a costly study involving preparation of a hydrologic model for the area, which would then be correlated to vegetative cover. We do not have the expertise in our office to produce these models. However, we think your analysis should include estimates of what proportion of the water that presently enters Ciénaga San Pedro during a one or two year flooding event will be retained by each of the flood control alternatives to be presented in the GDM. This will allow a qualitative prediction of potential effects on these wetlands. Review of maps and aerial photographs indicates expansion of mangrove forest into what was previously herbaceous marsh. This is undoubtedly a result of increased coastal saline intrusion. Although this is expected to occur to some degree without the project, construction of the levee would most likely accelerate this process. Increased salinity and decreased flushing by fresh water pulses in the mangroves will also favor growth of black mangroves over red mangroves and a general decline in canopy height and primary productivity. We are unable to quantify these changes.

Although San Pedro swamp is included in the publication Critical Wildlife Areas of Puerto Rico (Puerto Rico DNR, 1979), the difficulty in studying the wildlife of the inner portions of the marsh has produced only casual observations around its edge. The area has not been adequately studied, but information at hand indicates that although all wetlands provide valuable wildlife habitat, San Pedro is not as productive for waterfowl as, for example, Humacao Lagoons, Caño Tiburones or the Cabo Caribe swamp. Some hunting of doves and pigeons occurs around the edges of San Pedro, and we expect that gallinules, rails, and night herons, which are found deep within the vegetation, are present, but are difficult to census by aerial surveys. Although the Service recommends maintenance and rehabilitation of all of Puerto Rico's limited wetlands, we cannot classify San Pedro as one of the most important wildlife areas on the island.

RIO DE LA PLATA SURVEY INVESTIGATION
APPENDIX F
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Office of the Governor
La Fortaleza
San Juan, Puerto Rico 00901

March 9, 1982

Col. Alfred B. Devereaux
District Engineer
U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232

Dear Col. Devereaux:

Ten years have passed since the Corps, in coordination with the Government of Puerto Rico, established a major planning effort to assist Puerto Rico in water resources planning and development. The Corps studies and technical assistance have considerably enhanced the capability of the Government of Puerto Rico for more effective and efficient water resources planning.

Initially Corps efforts were oriented at framework, general assessments and regional type studies. These studies were quite comprehensive and detailed. In some cases alternative plans for solutions of water problems, particularly water supply, were given. The studies were very useful for further planning activities. However, they did not provide a basis for recommending specific actions or projects in particular areas.

At the request of the Government of Puerto Rico, the Corps planning efforts were shifted to the preparation of feasibility flood control studies for relatively large and complex drainage basins. These studies involved many years of effort to complete. Though we have no doubt that projects for those areas could be economically justified, the local funds required to undertake several large flood control projects simultaneously are not available.

As a result of our February meeting and several other meetings we have held with Col. Burns and other staff members of the COE District Planning Division, we strongly feel that there is a need for a reorientation of the Corps flood control planning program in Puerto Rico.

Efforts should be concentrated on the preparation of feasibility studies for several relatively small flood control areas throughout the island. These areas appear to qualify for the Section 205 Flood Control Continuing Authority Program. Studies for these areas could be completed in less than two years and construction could take place within a reasonable time period. Also, since their local funding requirements are much smaller than in the case of large scale projects, there is a possibility that the Government of Puerto Rico could provide support for some of them in the future.

We also need the help of the Corps to complete or initiate survey investigations in several major basins throughout the island, which present serious flooding problems. We understand this will require specific Congressional authorization and appropriation, and we are coordinating with the Resident Commissioner to obtain the needed Congressional resolutions and funding.

A third area where we are requesting the assistance of the Corps is in the preparation of flood evacuation plans for several flood plain areas and the development of an Islandwide Inventory and Diagnosis of local flooding problems. This Inventory, which will be undertaken primarily by the Puerto Rico Department of Natural Resources, would serve as a basis for new starts under the 205 Small Flood Control Program. Considering the severity of the flooding problem, the availability of data, and potential for eligibility of project implementation, our request under each of your programs and in order of priority is as follows:

205 Small Flood Control Program:

1. Complete study for Río Guanajibo at Sabana Grande.
2. Prepare study for Río Cibuco at Vega Baja.
3. Prepare study for Río Santiago at Naguabo.
4. Prepare study for Río Nigua at Arroyo.
5. Complete study for Río Tallaboa at Peñuelas.
6. Initiate study for Río Yauco at Yauco.
7. Initiate study for Río Guayanilla at Guayanilla.

Survey Investigations Program

1. Complete study and coordination for Río Puerto Nuevo in San Juan.
2. Initiate Survey Report for Río La Plata at Toa Baja and Dorado.
3. Continue Survey Report for Río Grande de Loíza.
4. Continue Survey Report for Río Guanajibo.
5. Initiate Survey Report for Río Grande de Arecibo.
6. Complete and Coordinate Report of the Puerto Rico and Virgin Islands Pipeline Study.

Planning Assistance to States Program

Under this program we would like the Corps to help us prepare temporary evacuation plans for the lower part of Río Grande de Loíza and Río La Plata. Also we are asking for your technical assistance in the preparation of an Islandwide Inventory and Diagnosis of areas with local flooding problems.

This is our requested program for flood control planning assistance during the next three years (1983-1985) from the U.S. Army Corps of Engineers. The Department of Natural Resources will coordinate and act as the principal sponsor for Corps activities in this area. All requests from the various municipalities will be coordinated and prioritized by the Department of Natural Resources to facilitate construction of flood control projects in their areas.

We look forward to continued support of the Corps in water resource planning and development in Puerto Rico.

Cordially,

Carlos Romero Barceló

Carlos Romero-Barceló

May 28, 1985

U.S. Army Corps of Engineers
Fernández Juncos 400
Stop 7 1/2
Puerta de Tierra
San Juan, Puerto Rico

Dear Gentlemen:

In accordance with the provisions of House Concurrent Resolution Number 6, approved by the House of Representatives and the Senate of Puerto Rico, and pursuant to Section two (2) of the same; I am forwarding a certified copy of the above stated Resolution so that you take cognizance of its scope and for the corresponding action on the part of the corps.

I would appreciate your informing us of the measures that you were able to take in relation to that which is requested by the Resolution so that in due time I may inform the House of Representatives as well as the Honorable Senate of Puerto Rico.

I am thus informing you of the preceding matter for appropriate action.

Sincerely yours,

José Ramón Morales
Secretary

CONCURRENT RESOLUTION

To request that the United States Army Corps of Engineers give priority attention to the investigation, study and prompt channelling of the La Plata River in the municipality of Toa Baja.

STATEMENT OF MOTIVES

The problem of flooding in the municipality of Toa Baja is one of great concern. The frequent floods cause a situation which threatens the life and property of the residents. The La Plata River extends from the municipality of Toa Baja to the municipality of Dorado, and passes directly through the town of Toa Baja, making it a high risk zone for the businesses and residences, as well as several schools that are also located within the floodable area.

Each time there is continuous rainfall, the uncontrolled waters of the river unleash their fury leaving hundreds of people homeless and incommunicating the municipalities because of the damage caused to the access routes.

The study of the La Plata River channeling project is being conducted by the United States Army Engineeer Corps, which administers a program under Section 205 of the 1948 Flood Control Act, whereby it can provide the participation of Federal funds up to a maximum of four million dollars for each project. In order to do so, they must study the project which must have a positive [illegible] (Section 20- [illegible] Section 22), according to the established parameters.

For this reason we are requesting the United States Army Corps of Engineers to give priority attention to the investigation, study and prompt channeling of the La Plata River and the plans or alternatives for improvement of the area.

BE IT RESOLVED BY THE LEGISLATURE OF PUERTO RICO:

Section 1.-To request the United States Army Engineer Corps to give priority attention to the investigation, study and prompt channeling of the La Plata River from the municipality of Toa Alta to the beach in the municipality of Dorado.

Section 2.- A copy of this Concurrent Resolution shall be sent to the United States Corps of Engineers and to the Department of Natural Resources of the Commonwealth of Puerto Rico, as well as to the news media.

And in testimony thereof, I issue this Certificate in my office, at the Capitol Building in San Juan, Puerto Rico, and set my hand and affix the Seal of this House of Representatives hereon, this first day of May of the year nineteen hundred and eightyfive.

José Ramón Morales
Secretary of the
House of Representatives

MAY 06 1986

LT. Col. Stanley G. Phernambucq
U. S. Army Corps of Engineers
Jacksonville District - SAJSA
400 Fernández Juncos Avenue
San Juan, Puerto Rico 00901

Dear Colonel Phernambucq:

Reference is made to the April 22, 1986 meeting in your offices regarding plan formulation for the Río La Plata flood control study.

With the information provided at this stage, we consider that Plan E, levees and a partial channel realignment, appears to be the most favorable solution.

We look forward to the completed Survey Investigation so that a formal commitment may be reached between local and federal agencies for the implementation of flood control measures.

Cordially,

Alejandro Santiago Nieves
Secretary

ESTADO LIBRE ASOCIADO DE PUERTO RICO
OFICINA DEL GOBERNADOR
JUNTA DE PLANIFICACION

Centro Gubernamental Minillas Edif. Norte
Ave. De Diego Pda 22
Apdo 41119 San Juan, P.R. 00940 [illegible]

15 de mayo de 1986

Ing. Emilio Colón
Jefe, División de Ingeniería
Cuerpo de Ingenieros
400 Fernández Juncos
San Juan, Puerto Rico 00901

Estimado ingeniero Colón:

Hacemos referencia al estudio de Control de Inundaciones del río La Plata discutido el pasado 22 de abril de 1986 en sus oficinas. Correspondiendo a su solicitud, procedimos a evaluar el mencionado estudio a la luz de las políticas vigentes sobre usos de terreno, y de las implicaciones que el mismo tiene sobre los planes de desarrollo para el área de Dorado y Toa Baja. A continuación nuestros comentarios.

Las primeras cuatro (4) alternativas discutidas se descartan, bien sea por su alto costo, o por lo limitada que son en términos de la protección que ofrecen a las áreas susceptibles a inundación. De las restantes dos (2) alternativas, la que propone la canalización del río La Plata, conlleva una inversión millonaria, por lo que el propio Cuerpo de Ingenieros entiende que sería poco probable que el Congreso la autorizara. Esto nos deja con la alternativa E, que consiste en la construcción de diques a lo largo de la PR #165 y de la PR #693. Reconocemos las bondades de esta opción, en términos de costo (más bajo), y en términos de la cantidad de terrenos (desarrollados y vacantes) que se protegerán contra inundaciones. Nos preocupa, sin embargo, el efecto que tendría la misma sobre los terrenos de alta capacidad agrícola (alrededor de 2000 cuerdas) que quedarían entre los dos diques. Igualmente nos preocupa, que aún con esta alternativa el Municipio de Toa Alta tendría problemas de accesos en caso de inundación severa. Por lo tanto, sugerimos se estudie la posibilidad de incluir como parte de esta alternativa las medidas estructurales necesarias para que la Carretera PR #165; que sirve de acceso a Toa Alta y otros pueblos del interior no se afecten por las inundaciones.

Nos interesa, además, hacer unos breves comentarios sobre la metodología usada para evaluar y seleccionar la mejor alternativa. Entendemos que mediante el análisis de costo/beneficio fue que se analizaron las diferentes alternativas. Mediante este método se computaron los beneficios de las diferentes alternativas en base al uso más rentable que se daría a los terrenos una vez se corrigiera la situación de inundabilidad.

Esta parte de la metodología nos preocupa, ya que le crea una presión de desarrollo a terrenos de alta capacidad agrícola, que merecen ser conservados para ese uso. Debe recordarse, además, que existen políticas públicas precisas dirigidas a proteger estos terrenos, por lo que los planes y proyectos de las instrumentalidades públicas deben incorporar en sus trabajos dichas recomendaciones.

Nos permitimos sugerir el que se aclare en el documento final sobre el proyecto, que en los terrenos a rescatarse, los usos a que se destinen éstos, armonizarán con los Objetivos y Políticas Públicas Sobre Usos de Terrenos del Gobierno de Puerto Rico. Sugerimos además, se incorpore al Departamento de Agricultura en el proyecto, con el objetivo específico de preparar un Plan de Desarrollo Agrícola para las aproximadamente 12,000 cuerdas que se rescatarían de la zona inundable. Esto, unido a la reglamentación sobre uso de terreno que nuestra Agencia implantaría en el área, serviría para guiar en forma organizada el desarrollo de los terrenos a afectarse por el proyecto.

Aprovechamos para enviarle una relación detallada de las características principales (capacidad productiva y propiedades físicas) de los suelos afectados por el proyecto.

Confiando que nuestros comentarios y la información suministrada sea de utilidad en las etapas subsiguientes de tan importante proyecto, queda de usted

Cordialmente,

por: Lina M. Dueño
Patria G. Custodio
Presidente

CIUDAD DE DORADO

Alfonso López Chaar
ALCALDE

April 25, 1986

LtCol Stanley G. Phernambucq
Deputy District Engineer for Puerto Rico & Virgin Islands
U.S. Army Corps of Engineers
400 Fernández Juncos Ave.
San Juan, Puerto Rico 00901-3299

Re: La Plata River Flood Control Alternatives.
Response to April 22 meeting.

Dear LtCol. Phernambucq:

Implementation of flood control works for the La Plata River with federal participation may well be 15-20 years in the future. However, our Municipio is currently experiencing development pressures and we expect these pressures to grow significantly as soon as the Autopista reaches Dorado. Therefore, we want to orient development in Dorado during the near future in a manner that is compatible with the long range flood control plan.

After analyzing the flood control alternatives presented at the April 22 meeting we feel that Plan E will probably emerge as the favored plan. We have this conclusion on:

1. The high cost of Plans B, C and F;

2. The fact that Plan A, although less costly than Plan E, does not provide protection to Levittown and therefore will probably not pass the benefit: cost test; and

3. The unacceptability of relocating Toa Baja, as considered in Plan B and C.

Comments on Plan D. We, in Dorado, do not consider Plan D to be acceptable because as currently formulated it provides considerable land enhancement benefit to Toa Baja, without providing any similar type of land enhancement benefit to Dorado. As additional disadvantaged, Plan D is also more costly than Plan E and will probably lower total benefits than Plan E because less land is protected from flooding.

If Plan D is to be given further consideration, we specifically request that the proposed levee to the north of Dorado be altered to the alignment proposed in

Plan E in this same area, thereby providing Dorado with [illegible] in an area which is of critical concern to us. This dike would be [illegible] of the ring levee currently painned unde Plan D.

Comments on Plan E. This plan although probably the most cost effective intervention, presents several major problems that should be properly addressed. Significant additional costs will be involved in the required relocation of various dairy farms currently on the area defined the future levees. The construction of the levees at the proposed elevations, (5 meters) and the required elevation of the proposed bridge will create a major impact in the "marina" sector of Dorado (calle Industria), that requires special attention.

Another important issue, pertinent to all the solutions, presented is the impact from the levee construction on the "mogotes". There value both as source for fill material and a scenic and environmental resourse is in clear conflict. Additional information as to extent of this impact is required prior to any final commitment.

Request for Analysis of Early Implementation Impact. We strongly desire to promote residential development in the flood-prone area immediately north of the City of Dorado. The purpose of developing this area will be to reinforce the town's traditional business district, as opposed a more spread-out development to begin as soon as possible using a combined highway and flood control dike which is 100% compatible with the long range flood protection plan which is selected for implementation. If we do not undertake this improvement in the near future, a deterioration of the tradition of Dorado business district may occur which will be very difficult to reverse.

Since we whish to begin development of this area north of Dorado as soon as possible, we request that analyze the adverse effects, if any, which would accompany the development of a levee extending north from Dorado prior to initiating any other phase of the flood protection works which might be planned.

In closing, I whish to congratulate the Corps of Engineers for their excellent and informative presentation of the alternative plans and their implications, and for the opportunity to be involved in the planning process. We hope that our input is of assistance in the formulation of a plan which provides the greatest possible benefit and promotes the orderly development of the areas affected by flooding of the La Plata River.

Sincerely,

Alfonso López Chaar
Mayor

Gobierno Municipal
Apartado M
Toa Baja, Puerto Rico 00759
Tels.: 794-1195 - 794-2690

Victor M. Soto Santiago
Alcalde

April 22, 1986

Lt. Col. Stanley G. Phernambucq
Deputy District Engineer for
Puerto Rico & Virgin Islands
Corps of Engineers
400 Fernández Juncos Avenue
San Juan, Puerto Rico 00901-3299

Att. Planning Group

Dear Sir:

In the name of my fellow citizens and myself, we want to thank the interest and effort of the Corps of Engineers Planning Group, for studying the feasible alternatives to solve the flooding problematic that is affecting the area.

As agreed in our meeting, April 22, 1986, here is a profile of Toa Baja and the most significant impacts of the proposed plans.

POPULATION

The Municipality of Toa Baja, given its geographical location, forms part of the metropolitan surroundings of San Juan. This geographical position exposes the Municipality to a constant population growth, demanding an economic structure development capable to serve the demands of population increase.

According to the population census of 1980, Toa Baja counted with 78.246 habitants, with a population density of 3,682.5 habitants per square mile and a birth rate of 21 newborns per thousand habitants; 40.2 percent of the population is younger than 18 years. The 54.9 percent of the population fluctuates between 18 and 64 years old, with an average age of 23.7 years.

Our senior citizens, 65 years old or more, represent only 4.9 percent of the population, being this the lowest percent level in all Puerto Rico. Of the population over 25 years of age 43.9 percent has a high school diploma; although, 10.4 percent of the population over 18 years of age are considered illiterate. Our updated population estimates fluctuate around 90,000 habitants.

HOUSING

The total of housing units approximates 24,923 units for 1985, of which 90.65 percent are occupied, and 7.55 percent of them are lacking sanitary facilities. The average value of a housing unit is $27,700.00 and an average monthly rent will be $162.00 per housing unit rented.

LABOR FORCE

Toa Baja is known as a Dormitory Municipality, meaning that mainly the people exerts their economic activities outside the Municipality and returns to sleep. This condition has caused a decreasing economic activity, where more than 60 percent of the population is under the poverty level, and a 20 percent unemployment.

The Municipality counts with a Labor Force of 50,111 people, 16 years old or more, of which 45.81 percent represents the civil workers group. The per capita income is $2,273.00; and the mean family income is $7,267, which is over the mean family income for Puerto Rico.

PHISICAL CHARACTERISTICS

In Toa Baja, nearly 50 percent of the population lives in flooding areas, which represents 6,862 cords or.43 percent of the total area. The phenomenon of a significant percent of the population living in flooding areas is the result of a no planning urban development process. This means, that the early establishment of Toa Baja came mainly by land invasion and lot projects without a proper infrastructure. To this deficiency sums the defective drainage systems, at planning areas.

FLOODS EFFECTS

The condition of the flooding and mountainous areas prevailing in the Municipality of Toa Baja are causing a continued state of emergency of natural disasters.

The flood record occured in September 1928: a peak of 120,000 cubic feet per second passed Toa Baja during this flood. Other major floods have occured in 1899; 1943: 1960: 1970; 1979: and 1985.

Declared by the President of the United States of America, a National Disaster Zone, on October 1985 Toa Baja suffered losses amounting to:

$7,353,541	of households property
$ 710,235	of public property
$ 605,790	in the sector of commerce
$ 158,189	in the sector of agriculture

for an estimated grand total of $8,827,755.

CONCLUSION

After analyzing the plans proposed in the flood control study for Rio La Plata, we conclude, that the Municipality of Toa Baja cannot accept, under any circumstances, the plans B and C; which are proposing the relocation of the Toa Baja Town out of the flood plain. They attempt against our sociological identity; not only of the 1,992 residents or 439 families at Toa Baja Town, but of all the citizens and people that were born in the Municipality of Toa Baja. This creates a psycological crisis proved throgh history; human beings need to know where they come from and have a deep feeling of belonging. Emotionaly their roots are represented by the country or land that gives them their social identity and individuality. In Puerto Rico, where the people have very strong religious bellieves, the Municipality Town is the heart of that identity where they celebrate the Patrons Feast in the Town Square as part of our folklore and culture. In Toa Baja the Patrons Church was constructed in 1745, where still today they bring their dead relatives to be blessed in that church and walk in a funeral procession to the cementery where their ancestors rest. Definitely, the citizens of Toa Baja would not accept, under any circumstances, the relocation of the Town.

On the other hand, the implantation of Plan E will be of accountable importance for the future economic development of the Municipality and security of our people. The levees will free thousands of acres for urban, industrial and agricultural development. There are federal funds available for housing proyects in this area, but our land is restricted by the flooding condition. Our soil is considered the most fertile, but the loses suffered each time there is a flood, makes agriculture a sustaining loss activity. The industrial development is affected in the same way, leaving our economic development at a minimun rate, and a high rate of unemployment.

Once again, we thank the corps of engineers for this study and are looking forward for the solution of the floods ocurrence in the Municipality of Toa Baja.

Sincerely yours

Victor H. Soto Santiago

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Caribbean Field Office
Box 491
Boquerón, Puerto Rico 00622

February 25, 1986

Dr. Emilio M. Colón
Chief, Planning Group
U.S. Army Corps of Engineers
400 Fernández Juncos Ave.
San Juan, Puerto Rico 00901

Dear Emilio:

We have reviewed your proposal for flood protection at Río de la Plata. You have solicited FWS comments regarding the raising of Highway 165 from the De Diego Expressway to the el Mameyal sand dune to act as a levee. Apparently, you had previously considered construction of ring levees around Toa Baja, Ingenio, and Campanillas communities. We did not have information regarding proposed flood control structures when we completed our resource report on October 31, 1983, and we did not then include the Río Cocal mangroves or San Pedro marsh in our study area. This letter is a suppliment to that report; our comments are issued in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The proposed levee would not result in any direct destruction of important wildlife habitats, however, you are correct in suggesting that it will probably reduce flow of fresh water to the mangroves and fresh water marshes located to the east, in Sabana Seca Ward, Municipality of Toa Baja. We have calculated that the Mameyal mangrove covers a total area of about 23 hectares (57 acres). The Río Cocal mangroves cover approximately 112 hectares (277 acres), while the adjacent fresh water marsh, Ciénaga San Pedro, measures 420 hectares (1038 acres). A second fresh water marsh lies south of Highway 867, covering 168 hectares (415 acres). Ciénaga San Pedro and the Río Cocal mangroves would be the most affected by the project.

The only streams bringing fresh water into the wetlands from west to east are Río Cocal and Caño Campanero. The proposed plan appears not to effect Caño Campanero, but would isolate Río Cocal from its source of water, Río de la Plata. Sheet flow of water across the agricultural lands into the wetlands is probably an important inflow during floods, although the extent to which the present road bed contains flood water must be considered. Urban development and the channelization of the Río Bayamón have limits inflow of fresh water from the east. To the south, there is a series of karstic hills which are quite permeable to water. We think that a large percentage of the water flooding Ciénaga San Pedro is seepage of low-salinity groundwater through these hills. Figures 1 and 2 show that water hardness and chloride concentration of groundwater in the unconfined aquifer are lower in the vicinity of the Sabana Seca and Cucharillas wetlands (Anderson, 1976). This implies an input of less saline groundwater. Figure 3 shows an elevated water table in the Candelaria area, which could drive the percolation of water through the limestone to the Sabana Seca marshes and mangrove forests, where the water table is at or above the ground surface (Torres-González and Díaz, 1984). We therefore think that isolating these wetlands from Río La Plata will not dry them out, however periodic pulses of surface flows of fresh water during heavy rainfall will be greatly reduced.

With present information, we can only make generalizations about the effects of this project on the wetland vegetation. Retention of water within the levee will reduce water depth and the length of time surface water is present in the wetlands. The extent of change in vegetation could be predicted, but this would require a costly study involving preparation of a hydrologic model for the area, which would then be correlated to vegetative cover. We do not have the expertise in our office to produce these models. However, we think your analysis should include estimates of what proportion of the water that presently enters Ciénaga San Pedro during a one or two year flooding event will be retained by each of the flood control alternatives to be presented in the GDM. This will allow a qualitative prediction of potential effects on these wetlands. Review of maps and aerial photographs indicates expansion of mangrove forest into what was previously herbaceous marsh. This is undoubtedly a result of increased coastal saline intrusion. Although this is expected to occur to some degree without the project, construction of the levee would most likely accelerate this process. Increased salinity and decreased flushing by fresh water pulses in the mangroves will also favor growth of black mangroves over red mangroves and a general decline in canopy height and primary productivity. We are unable to quantify these changes.

Although San Pedro swamp is included in the publication Critical Wildlife Areas of Puerto Rico (Puerto Rico DNR, 1979), the difficulty in studying the wildlife of the inner portions of the marsh has produced only casual observations around its edge. The area has not been adequately studied, but information at hand indicates that although all wetlands provide valuable wildlife habitat, San Pedro is not as productive for waterfowl as, for example, Humacao Lagoons, Caño Tiburones or the Cabo Caribe swamp. Some hunting of doves and pigeons occurs around the edges of San Pedro, and we expect that gallinules, rails, and night herons, which are found deep within the vegetation, are present, but are difficult to census by aerial surveys. Although the Service recommends maintenance and rehabilitation of all of Puerto Rico's limited wetlands, we cannot classify San Pedro as one of the most important wildlife areas on the island.

You state that the plan would protect the agricultural lands from flooding. However, any plan that would protect the Ingenio squatter community, which is located adjacent to wetlands, will encourage urban development (planned or unplanned) of the agricultural lands. This seems to be a major drawback to the proposed plan, whereas the original plan involved protection of the existing communities, without providing incentives to further development of the present floodplain.

We expect that the new plan, which costs significantly less than the ring levees, will be selected to maximize net NED benefits. We think features can be incorporated in the recommended plan that will minimize adverse environmental effects. We recommend an engineering feature in the project's design to allow flow from Río La Plata to Río Cocal at a level that will not flood the Ingenio community. We would like to review a design for such a feature.

We recently inspected existing structures at the Highway 165 bridge over Río Cocal. The bridge spanning the creek is sufficiently wide to permit passage of water flowing from Río La Plata during heavy rains, however, an agricultural road just east of the highway has only two concrete culverts, approximately 3 feet wide each. Although high flows probably pass over this road, the flow could be improved. Since elevating the highway will involve the major expense of raising the bridge, providing a structure to allow an average one or two year flow will not significantly increase project costs.

Please let us know if we can cooperate in designing a system to provide flow to the Río Cocal. Thank you for the opportunity to comment.

Sincerely,

Paul E Gertler

Paul E. Gertler
Field Supervisor

Literature Cited

Anderson, H. R., 1976. Ground water in the San Juan metropolitan area, Puerto Rico. U.S. Geological Survey, Water Resources Investigations Report 41-75.

Puerto Rico Department of Natural Resources, 1979. Critical wildlife areas of Puerto Rico. Division of Coastal Resources and Wildlife Planning.

Torres-González, A. and Díaz, J. R., 1984. Water Resources of the Sabana Seca to Vega Baja area, Puerto Rico. U.S. Geological Survey, Water Resources Investigations Report 82-4115.

cc:
AHR, Atlanta, GA

OFFICE OF THE GOVERNOR
STATE HISTORIC PRESERVATION OFFICE
LA FORTALEZA
SAN JUAN, PUERTO RICO 00901

February 5, 1985

Mr. A.J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District, Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32201

Dear Mr. Salem:

We have received and carefully reviewed the report entitled Cultural Resources Reconnaissance of Río Cibuco, Río de la Plata and Río Santiago Flood Control Projects, P.R., prepared by Karell Archeological Services, and offer the following comments for your consideration.

This report adequately presents the results of the reconnaissance survey of the five project areas: Vega Baja survey area (Río Cibuco), Toa, Comerío and La Plata survey areas (Río La Plata), and Naguabo survey areas (Río Santiago).

Mr. Koski-Karell and Mr. Luis Muñoz, of Karell Archeological Services, visited our office during the past week (January 22-25), and discussed with Ms. Karen Anderson, of our staff, certain issues concerning this report. State Historic Preservation Office site numbers were assigned to the documented sites, and a copy of the SHPO site survey forms was provided to Mr. Koski-Karell.

This report clearly demonstrates the potential for the location of historic and prehistoric properties in the five project areas, especially in the case of the Vega Baja and Toa areas. Due to the large number of sites discovered during the reconnaissance survey and to the field conditions which in many cases, provided low visibility, we anticipate the need for intensive cultural resources survey in most, if not all, of the project areas. This will depend in part on the specific flood control project plans that the Corps may be considering for these rivers.

There should be a concerted effort to identify all potentially significant resources during the early stages of project implementation. A well executed and planned survey strategy is crucial for the proper management of cultural resources considerations and serves as a strong basis for the evaluation and mitigation phase of the section 106 process.

We are looking forward to a continued collaboration with the Corps concerning these projects.

Cordially yours,

Eng. César H. Nazario Yordán
Acting State Historic Preservation Officer

COMMONWEALTH OF PUERTO RICO

OFFICE OF THE GOVERNOR
SAN JUAN, PUERTO RICO 00901

December 30, 1986

Mr. A. J. Salem
Chief
Planning Division
Department of theArmy
Corps of Engineers
P.O. 4970
Jacksonville, Florida 32232-0019

Dear Mr. Salem:

On behalf of Rafael Hernández Colón, Governor of the Commonwealth of Puerto Rico, I want to acknowledge receipt of your December 4, 1986 letter with the enclosed draft report and environmental impact statement (EIS) regarding the Río La Plata Survey Investigation.

Since our corresponding Head of Agencies have the required expertise on this subject you should be receiving their comments directly from them.

As always please feel free to contact our office at (809) 721-4275 or 725-9265 if you need any help or information.

We take this opportunity to wish you and all the employees at the District Office of the Corps of Engineers in Jacksonville a Happy New Year.

Sincerely,

Paul M. Vilaró
Auxiliary Advisor on
Federal Affairs

Estado Libre Asociado de Puerto Rico
Gobierno Municipal
Apartado 2359
Toa Baja, Puerto Rico 00759
Tels.: 794-1135 - 794-2690

Victor M. Soto Santiago
Alcalde

January 26, 1987

Mr. A. J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District, Corps of Engineers
400 Fernández Juncos Avenue
San Juan, Puerto Rico

Dear Sir:

As requested on your letter of December 4, 1986, I am pleased to inform you that the Municipality of Toa Baja have no opposition to the recomendations and conclusions of the draft report and environmental impact statement for the Río La Plata Survey Investigation.

Previously, by letter of April 22, 1985, we enhanced the importance and accountability of Plan E for the future economic development of the Municipality and the security of our people.

After reviewing the draft report, all the comments we can have are of satisfaction; pleased that the alternative was selected in our favor. Other plans would have been of disastrous sociological effects to our fellow citizens.

Now we hope that the required approvals and appropiation of funds are made as soon as possible, given the priority this project has for the security of the habitants of the Municipality of Toa Baja.

Sincerely yours,

Victor M. Soto Santiago

Victor M. Soto Santiago
Mayor

mao

DEPARTMENT OF NATURAL RESOURCES

FEB 20 1987

Colonel Charles T. Myers III
District Engineer
Jacksonville Engineer District
U.S. Army Corps of Engineers
P.O. Box 3970
Jacksonville, Florida 32201-0019

Dear Colonel Myers:

After reviewing the Draft Survey Report for Río de la Plata, it is the intent of the Department of Natural Resources to enter into an agreement with the United States of America, represented by the Corps of Engineers, to implement the aforementioned project. Technical comments on the feasibility report will be provided at a later date.

The Government of the Commonwealth of Puerto Rico, acting through its Department of Natural Resources has legal authority and intends to seek approval of funding to provide the required items of local cooperation which are satisfactory to the President and the Congress of the United States of America at the time of executing a formal agreement. It is understood that as part of the requirements of local cooperation, which are described in the report, we must provide without cost to the United States all lands, easements, rights-of-way, alterations and relocations of structures and infrastructure necessary for the construction of the project.

It is further understood that this Letter of Intent is not a legally binding instrument between the parties and is subject to the final approval of a mutually agreeable contract by the parties.

Cordially,

Justo A. Méndez

Justo A. Méndez
Secretary

DNR

DEPARTMENT OF NATURAL RESOURCES

February 24, 1987

Mr. A. J. Salem
Chief
Planning Division
Department of the Army
Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232-0019

Subject: Environmental Impact
Statement Río La Plata
Survey Investigation
DIA-1286-014 P

Dear mister Salem:

We have reviewed the Draft Report and Environmental Impact Statement for the Río La Plata Survey Investigation. The Study addresses the flooding problems of Toa Alta, Toa Baja and Dorado caused by overflows of Río La Plata and investigates alternatives to solve these problems.

The Department of Natural Resources comments to the E.I.S. are the following:

1. Remarks to description of environmenral impacts under the different alternatives, as shown in expanded Table 9 (Page 27-B, C, D, E).

   a) Under "Federal Threatened and Endangered species", add West Indian Manatee, Trichechus Manatus.

   b) Under "Water Quality", deepening and widening the channel ("Alt. E") will cause increase in average flow velocity near the river mouth, and the suspended sediment load of the river at its estuary, and will directly decrease water quality. Although such changes may be considered acceptable as a tradeoff of decreased flooding, it should be addressed in the E.I.S.

c) Under "Flora and Wetland", no impact is foreseen except for Alt. E., which supposedly will impact only riveredge vegetation. In fact, alternative E will remove all benthic and riveredge vegetation, and cause discharge of a turbid plume to nearshore shallow environments for many months. This impact should be reported. The shallow nearshore water near the mouth of the Río La Plata at Dorado are known as Manatee habitat. The Manatee is designated Endangered under Commonwealth and Federal Regulations, and we must avoid excessive habitat loss.

d) Under "Solid waste" the impact of Alt. E and F are not the same, as claimed by the table. Less material will be excavated under Alt. F since it will not include dredging of the Río La Plata Channel.

e) The cost-benefit analysis should compare the cost of dredging and channel maintenance with the cost of levee maintenance.

2. The Report mentions (Page 35) that four bridges will be replaced (PR-Highways 693, 2, 165 and 861). The effect on the bridge to be constructed in the De Diego Expressway (PR-22) should be discussed and included.

3. The E.I.S. should discuss the effects of the proposed channelization in the underground water resources.

You'll be receiving under a separate letter, the position of the Department of Natural Resources in regards with its present and future participation in this project as the Commonwealth of Puerto Rico Agency responsible for Flood Control Projects.

Thank you for the opportunity to comment.

Cordially yours,

Ruth D. Carreras

Ruth D. Carreras
Assistant Secretary for
Permits Area

ESTADO LIBRE ASOCIADO DE PUERTO RICO
DAGRICULTURA

APARTADO 10163, SANTURCE
PUERTO RICO 00908

10 de febrero de 1987

Mr. A. J. Salmen
Chief Planning Division
Department of the Army
San Juan Area Office-Corps Engineers
400 Fernández Juncos Avenue
San Juan, Puerto Rico 00901

Att: Mr. José A. Martínez

RE: "Survey Report"
Río La Plata, Puerto Rico

Estimado señor Salmen:

El Departamento de Agricultura de Puerto Rico, considera que el Plan "E" es la alternativa que propicia lograr los mayores beneficios del desarrollo económico, y a su vez cumple sustancialmente con el objetivo primordial de proteger la vida de los residentes del área inundable del Río La Plata. Además, dicho plan tiende a evitar las pérdidas de propiedad que ocasionan las inundaciones en dicha área, mejora las oportunidades para abrir nuevos desarrollos y preserva los recursos naturales, ambientales y culturales del área.

Por otra parte, deseamos hacer unas observaciones y/o recomendaciones para que se tengan presentes en cualquier determinación que se tome con relación a dicha área. Esta es un área de topografía llana y suelos de alto potencial agrícola. Una parte considerable de estos terrenos están dedicados al presente a la ganadería de leche, la cual es una de las empresas agrícolas de mayor importancia económica y potencial de desarrollo en la agricultura de Puerto Rico. Además, hay en el área otros terrenos que aunque no se estén explotando agrícolamente al presente, también poseen potencial agrícola.

Entendemos que el potencial agrícola de estos terrenos se incrementará, una vez estos sean rescatados de su condición de inundables, la cual facilitará que los mismos pueden utilizarse en parte para actividades agrícolas. Sobre este particular es pertinente que se reexamine la infraestructura contenida en el Plan E, para que se provea un medio adecuado de acceso a las 1,700 cuerdas que quedarán entre los diques a construirse y la canalización del río. Dichos terrenos pueden utilizarse en actividades agrícolas como la ganadería.

Por lo antes expuesto, recomendamos que los usos a darse a los terrenos a rescatarse se armonicen con los objetivos y política pública enunciadas en el Plan de Usos de Terrenos del Gobierno de Puerto Rico, preparado por la Junta de Planificación. Además, es pertinente señalar que en la disposición del material de relleno a obtenerse en la canalización del río, deben tomarse las precauciones necesarias para que no se afecten los terrenos con utilidad agrícola que existen en el área.

Cordialmente,

Juan Bauzá Salas
Secretario de Agricultura

Translation of letter from
Puerto Rico Department of Agriculture

10 February 1987

Mr. A. J. Salem
Chief Planning Division
Departemnt of the Army
San Juan Area Office-Corps of Engineers
400 Fernandez Juncos Avenue
San Juan, Puerto Rico 00901

Att: Mr. Jose A. Martinez

RE: "Survey Report"
Rio de La Plata, P.R.

Dear Mr. Salem:

The Puerto Rico Department of Agriculture considers that Plan E is the alternative that enhances opportunities for the attainment of maximum economic benefits for the area, and meets the principal objective of protecting the lives of the residents of the floodplain of Rio La Plata. In addition, this plan avoids the loss of property due to flooding in this area, improves opportunities for new developments, and preserves the natural, environmental and cultural resources of the area.

On the other hand, we wish to make some observations and/or recommendations that should be considered in any decision made regarding this area. This is an area with flat topography and soils with a high agricultural potential. A considerable portion of these lands are now used by the dairy farm industry, which is one of the most important agricultural enterprises in the island and has the highest growth potential. Also, there are other lands, which at present are not being used for agriculture but which have a high potential for this use.

We understand that the agricultural potential of these lands would be augmented once their floodable condition is eliminated, thus facilitating their utilization for agricultural activities. The infrastructure of Plan E should be reexamined to provide an adequate access to the 1,700 acres that would remain within the levees to be built. Those lands could be used for agricultural activities such as dairy farms.

It is reccommended that proposed uses for the lands be consistent with the objectives and public policy contained in the Land Use Plan of Puerto Rico, prepared by the Puerto Rico Planning Board. Also, all necessary precautions should be taken on the disposition of dredged material from the channel to minimize the impacts on lands with agricultural potential.

Cordially,

Juan Bauza Salas
Secretary of Agriculture

Translation of Letter From
P.R. Planning Board

17 March 1987

Eng. Emilio Colon
Chief, Engineering Division
Corps of Engineers
400 Fernandez Juncos Ave
San Juan, P.R. 00901

Dear Eng. Colon:

Reference is made to the environmental document recently circulated to different sectors of the community, relative to the flood control study for Rio La Plata. This document was discussed on a public hearing held the 27th of January in Toa Baja. The alternatives presented in the Environmental Impact Statement and discussed in the public hearing were evaluated using the benefit/cost methodology. In a previous communication (15 May 1986), we expressed our concerns in regards to this methodology, thus this issue will not be addressed at this time. However, we recognize that the document submitted incorporates various of our recommendations, specifically those relating to the agricultural lands within the project and to land uses in general.

Specifically, the abstract of the Environmental Impact Statement (Page EIS-15) incorporates the intent of the Board in regards to the preservation of agricultural lands and in regards to the consistency of future uses of lands reclaimed by the project with the public policies on land use defined and implemented by this Agency. Thus, we endorse the recommendation included in the EIS to the fact that lands to the east of the levee should remain in agricultural use.

Also, we favour the concentration of future urban expansion of Dorado to the west of the levee. Development plans for the municipio of Dorado are available (Dorado 2000), which identify sites for future development and the types of development for these sites. These plans should be taken into consideration by your Agency.

We believe the most reasonable alternative is Plan "E". This alternative represents a combination of two alternatives discussed in the initial stages of the study (April 1986) and includes channelization works and the construction of levees. However, we believe that the advantage of this alternative over the others presented could be diminished if it is considered that over 1,700 acres of land would be practically useless as a result of the implementation of alternative "E". Nevertheless, it is considered the most adequate in terms of costs and benefits derived.

We hope that these comments would contribute to the implementation of this project.

Cordially yours,

Patria G. Custodio
President

Estado Libre Asociado de Puerto Rico Oficina del Gobernador
JUNTA DE PLANIFICACION
Centro Gubernamental Minillas Edif Norte Ave De Diego Pda 22 Aptdo 41119 San Juan P R 00940 9985

17 de marzo de 1987

Ing. Emilio Colón
Jefe, División de Ingeniería
Cuerpo de Ingenieros
400 Fernández Juncos
San Juan, Puerto Rico 00901

Estimado ingeniero Colón:

Hacemos referencia al documento ambiental recientemente circulado entre diferentes sectores de la comunidad, relacionado con el estudio de control de inundaciones del Río La Plata. El mencionado documento fue discutido en una Reunión Pública, celebrada el 27 de enero en Toa Baja. Las alternativas presentadas en la Declaración de Impacto Ambiental y discutidas en la Reunión Pública señalada, fueron evaluadas por su Agencia utilizando la metodología de costo/beneficio. En nuestra comunicación anterior (15 de mayo de 1986), ya habiamos señalado unas preocupaciones respecto a dicha metodología, por lo que no abundaremos aquí sobre ese particular. No obstante, reconocemos que el presente documento sí incorpora unas recomendaciones nuestras, respecto al posible impacto del proyecto sobre los terrenos agrícolas, en particular, y sobre los usos de terrenos en general.

Específicamente en el abstracto de la Declaración de Impacto Ambiental, (pág. E.I.S.-15) se recoge la intención de la Junta respecto a la preservación de los terrenos agrícolas y la deseabilidad de que los usos de terrenos a generarse, una vez se liberen los terrenos de su condición de inundabilidad, armonicen con las políticas públicas sobre uso de terrenos enunciadas e implantadas por esta Agencia. En ese sentido, endosamos el señalamiento que se hace en la Declaración de Impacto Ambiental, respecto a la necesidad de mantener en uso agrícola los terrenos al este del dique.

Igualmente favorecemos el que las posibilidades de expansión urbana de Dorado se concentre en los terrenos al oeste del dique. Queremos señalar, sin embargo, que ya se han esbozado planes de crecimiento (Dorado 2000) para este Municipio, donde se han identificado lugares que se sugieren desarrollar, así como los tipos de desarrollo a dars en los mismos. Estos planes deben tomarse en cuenta en el proyecto que auspicia su Agencia.

Respecto a las alternativas recomendadas, nos parece como la más razonable, la identificada como "E". Aquí se presenta una combinación de dos soluciones discutidas al inicio del estudio (abril de 1986), y que consisten de una obra de canalización y la construcción de diques. Sin embargo, consideramos que la ventaja que ésta tiene sobre las otras alternativas podría ser menor si se toma en cuenta que había 1,700 cuerdas de terreno prácticamente inutilizables como resultado de dicha alternativa "E". Aún así, nos parece la más adecuada en términos de costo y del beneficio que se deriva.

Confiando que nuestros comentarios le sean de utilidad para la consecición de tan importante proyecto, queda usted,

Cordialmente,

Patria G. Custodio
Presidente

Translation of Letter From
P.R. Environmental Quality Board

2 March 1987

Eng. A. J. Salem, Chief
Planning Division
Corps of Engineers
San Juan Area Office
400 Fernandez Juncos Ave
San Juan, P.R. 00901

Attention: Mr. Jose A. Martinez

Re: Consultation on Flood Control for Rio La Plata in the vicinity of Toa Baja, Dorado, Puerto Rico

Dear Eng. Salem:

The Environmental Quality Board has reviewed the reference consultation and has the following comments.

The preliminary environmental impact statement to be submitted to this agency must be in spanish, meeting all the format and contents requirements specified in our Regulation for the Preparation of Environmental Impact Statements of 4 June 1984. The following comments should be incorporated into that document:

1. It should be specified if the pumping stations will have emergency generators.

2. According to the U.S. Department of Agriculture Maps, most of the lands in the basin are classified as prime agricultural land, being used mainly for pasture and dairy farms. The DEIS should be routed to the P.R. Department of Agriculture and should incorporate an analysis of any negative impacts of the proposed plan on these lands.

3. The geotechnical information is limited for the magnitude of the project. It is not indicated if continuous borings were performed, which are necessary to make decisions regarding the foundations of the project. Also, no detailed data on the engineering works to be performed are provided, such as the computed settlements, resistance to pressure, additional structural support and others. This data should be included.

4. The complete archeological study should be included as an appendix, including the location of the archeological resources found.

5. The impacts on wetlands, wildlife and the river biota should be discussed in detail.

6. Since the different alternatives proposed include channeling and dredging of Rio La Plata, NPDES permits should be obtained. It should be determined if the discharges would contain toxic solid wastes or their components (such as heavy metals, organic contaminants, etc). If the presence of contaminants is determined, the DEIS should be modified to include a sample of all dredged sediment to determine the concentration of contaminants. Also, it should include a quality assurance and quality control plan.

Once the document is received we will evaluate it and submit our comments.

Cordially yours,

Santos Rohena, Jr.
President

ESTADO LIBRE ASOCIADO DE PUERTO RICO / OFICINA DEL GOBERNADOR

Junta
de Calidad
Ambiental

DADA 379

2 de marzo de 1987

Ing. A.J. Salem, Jefe
División de Planificación
Cuerpo de Ingenieros
Oficina de Area de San Juan
Ave. Fernández Junco Núm. 400
San Juan, Puerto Rico 00901

Atención: Sr. José A. Martínez

Re: Consulta de Control de Inundaciones para el Río La Plata en el Area de Toa Baja, Dorado, Puerto Rico

Estimado ingeniero Salem:

La Junta de Calidad Ambiental (JCA) ha revisado la consulta del proyecto de epígrafe y tiene los siguientes comentarios.

La Declaración de Impacto Ambiental preliminar a someter deberá estar redactada en el idioma español, cumpliendo con todos los requisitos de formato y contenido específicados en nuestro Reglamento sobre Declaraciones de Impacto Ambiental del 4 de junio de 1984. En dicho documento deberán aclararse los siguientes aspectos.:

1. Deberán especificar si las estaciones de bombas tendrán generadores de emergencia.

2. Según los mapas del Departamento de Agricultura Federal en la cuenca en gran parte los terrenos están considerados como de importancia agrícola primaria utilizándose para pastoreo y vaquerías entre otros. Debido a está circunstancia, dicho documento deberá circularse al Departamento de Agricultura discutiendo cualquier impacto negativo que el mismo pueda tener en dichos usos del terreno.

3. La información geotécnica es breve ya que con solamente siete (7) perforaciones para un proyecto de esta magnitud se puede considerar límitada. En

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MAR 17 1987
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adición en los "boring logs" no indican si se realizaron muestreos continuos ("continuos borings"), necesarios para tomar decisiones en cuanto a las fundaciones de las obras. Tampoco se detallan datos específicos para las obras de ingeniería a realizarse como los asentamientos calculados, resistividad a presión, soporte estructural adicional y otros. Esta información deberá ser incluida.

4. El Estudio arqueológico deberá incluirse completo como un apéndice que incluya la localización de los recursos arqueológicos encontrados.

5. Deberá discutirse ampliamente el impacto sobre los terrenos anegadizos y su vida silvestre, así como los impactos sobre la biota del río, contestando las interrogantes de las agencias concernidas sobre el particular.

6. Debido a que en las diferentes alternativas propuestas se contempla la canalización y dragado del Río La Plata, deberán cotejarse todos los permisos de descarga NPDES y determinar si hay descargas que contengan desperdicios sólidos peligrosos o sus componentes (ej. metales pesados, contaminantes orgánicos, etc.). De ser afirmativo, la D.I.A. tendrá que ser modificada para incluir un muestreo de todo tipo de sedimento dragado del Río la Plata para determinar las concentraciones de contaminantes en el sedimento, que lo podrían clasificar como peligrosos. Además, deberá incluir un plan de muestreo y análisis que incluya al control de calidad y certeza de calidad ("Quality assurance y Quality Control") a ser utilizado.

Una vez recibamos el documento procederemos a su evaluación para emitir nuestros comentarios

Cordialmente,

Santos Rohena, Jr.
Presidente

IVL/SR/sv

GOBIERNO
del
ESTADO LIBRE ASOCIADO
de la
ISLA DE PUERTO RICO

OFICINA DEL GOBERNADOR
LA FORTALEZA
SAN JUAN DE PUERTO RICO

MARIANO GERARDO CORONAS CASTRO
DIRECTOR / OFICIAL

January 9, 1987

Mr. A.J. Salem
Chief, Planning Division
Department of the Army
Jacksonville District, Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

RE: **EIS#12-04-86-03**
Río de la Plata Survey
Investigation, Draft
Environmental Impact
Statement, Toa Alta,
Toa Baja and Dorado, P.R.

Dear Mr. Salem:

We have received and reviewed the above referenced Draft EIS. We were pleased to see that it includes the results of the archaeological reconnaissance which will be of use in the planning process.

We agree that for various reasons Plans A, B, C and D are impractical. However, we are not in complete agreement that Plan E is the best alternative, and feel strongly that Plan F should be the selected alternative.

According to the DEIS Plan E would impact fourteen (14) historic and prehistoric sites, this is more sites than would be impacted by any of the other six plans. This includes potential impact to an historic property, Hacienda Santa Elena (1. Site TB-8), determined eligible for listing on the National Register of Historic Places on July 22, 1983, and also on the Historic American Buildings Survey. This site would remain in the flood zone in Plan E or F, but construction of the channel in Plan E has greater potential for impact.

By our calculations, sixteen (not 14) sites would potentially be impacted by Plan E, as follows:

1. Dikes along the river would directly impact sites 8, 18 and 23.

2. Bridges would impact sites 6, 10 (not on the list of sites subject to impact in the DEIS) and 11, and possibly site 24.

3. Channelization would impact sites 6, 9, 11, 13, and 17 (not on the list of sites subject to impact in the DEIS).

4. It is unclear how the remaining seven (4, 5, 7, 14, 15, 16 and 32) of the fourteen sites mentioned is the DEIS would be affected by Plan E. We assume that with the increased construction activity involved with the channel building that they would be vulnerable if not directly affected.

Plan F, austensibly would in turn affect only three (3) sites, sites 8, 18 and 33 which are in the areas of the proposed dikes. Bridges are fewer, but longer in this plan and appear not to affect cultural resources. There is no channel proposed for Plan F, therefore it is assumed sites within the area bounded by the dikes should not be directly affected.

The location of all temporary staging areas, stockpiling areas, haul roads, highway reroutings, borrow areas and related earthmoving and construction activities should be considered from the outset to assure that they will not be placed in or near known cultural resources, regardless of which plan is finally accepted.

A summary of the importance of three of the sites which would be impacted by Plan E may be useful.

> "4. Site TB-7 (Santa Elena prehistoric site)" is the type site for the Santa Elena ceramic style as defined by Dr. Irving Rouse in the 1950's. Therefore, in addition to its potential for yielding routine archaeological data it is a key site in terms of chronology building for Puerto Rico and the Caribbean making it very significant.
>
> "5. Site TB-8 (Hacienda Santa Elena)" was determined eligible for listing on the National Register of Historic Places. The site includes a complex of large buildings and was clearly an important hacienda during the Spanish Colonial period between 1790 and 1910. Some experts suggest it may also be the original "Hato del Rey. (Royal Farm) of Hacienda del Toa founded by Juan Ponce de León c. 1508 which was the first agricultural experimental farm in the Americas.

> "6. Site D-5 (Puente de los Reyes)" actually "Puente de los Reyes Católicos" (Bridge of the Spanish Kings), whose eastern and western ends still remain is a brick and rubble construction built in 1826-1827. It is a locally significant landmark and one of the few, and possibly the oldest surviving example of large Spanish bridges constructed on the Island.

The remainder of the sites which Plan E would impact include little studied, prehistoric, Spanish Colonial, and post-Spanish open sites, house sites, surface scatters, farm steads, sugar mills, haciendas, and railroad bridges whose research potential is presently unknown.

It would seem that Plan F, not only in terms of cultural resources (three directly affected rather that sixteen for Plan E) but in terms of the natural environment would be the best. Because Plan F would not include a channel the flora and fauna along the riverbank and at the rivermouth would not be affected.

Please note that the PR Office of Cultural Affairs has been disbanded and that it is the Puerto Rico State Historic Preservation Office who is now responsible for review of EIS's. If there are any questions please contact Archls. Karen Anderson or Jeff Walker of our Staff.

Cordially yours,

Mariano G. Coronas Castro

MGCC/KAC/JW/mlrc

cc: Lt. Col. Stanley Phermanbucq; USACE, San Juan

Dra. Eda Burgos; ICP

March 3, 1849

United States Department of the Interior
FISH AND WILDLIFE SERVICE

Caribbean Field Office
P.O. Box 491
Boqueron, Puerto Rico 00622

January 14, 1987

José A. Martinez
Chief, Planning Group
Department of the Army
Corps of Engineers
400 Fernandez Juncos Avenue
San Juan, PR 00901-3299

Dear Mr. Martinez:

This is in response to your December 8, 1986, letter concerning the proposed Rió La Plata flood control project in Dorado, Puerto Rico. Levees will be constructed at five locations and the river will be widened and deepened from its mouth upstream to Toa Alta. We have assigned Log #4-4-87-027 to this activity and would appreciate your referring to it in future correspondence.

We concur with your identification of Federally-listed species likely to occur in the project area. These species are the endangered Puerto Rican boa (Epicrates inornatus) and the endangered Caribbean brown pelican (Pelecanus occidentalus). After reviewing the Corps' Rio de la Plata Survey Report and other available information, we agree that there should be no adverse impacts on these species.

This does not constitute a Biological Opinion as described under Section 7 of the Endangered Species Act (ESA). However, it does fulfill the requirements of the Act and no further action is required. If modifications are made in the project, or if additional information indicating potential impacts to listed species becomes available, consultation should be reinitiated.

Please note that informal consultation is voluntary; it is a method by which a Federal agency, such as the Corps, can avoid formal consultation if the Service concurs in writing with the agency's determination that its action is not likely to "adversely affect" listed species. Therefore, coordination is not complete until we concur with your finding.

If you have any questions or would like to discuss these issues further, please do not hesitate to write or call this office.

Sincerely,

Paul E Gertler

Paul E. Gertler
Field Supervisor

cc:
DAWE(SE), Atlanta

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Caribbean Field Office
P.O. Box 491
Boqueron, Puerto Rico 00622

February 21, 1987

Mr. José Martínez
Chief, Planning Section
U.S. Army Corps of Engineers
400 Fernandez Juncos Avenue
San Juan, Puerto Rico 00901

Re: Río de la Plata Survey Report

Dear Mr. Martínez:

We have reviewed the above referenced report describing flood control measures for Río de la Plata. This is the first opportunity for the Fish and Wildlife Service to review specific design alternatives. Informal oral descriptions of the project by the Corps prior to our Planning Aid Report (dated October 31, 1983) indicated that ring levees around flood-prone communities (similar to Plans A or B in the Survey Report) would be the most likely flood control measure. Our letter dated February 25, 1986, responded to a general written description (without drawings) of another design concept (similar to Plan C in the Survey Report) involving raising the level of Highway 165 to act as a levee. That letter recommended incorporating a design feature allowing fresh water flow from Río de la Plata to Río Cocal. The mangroves in the Río Cocal drainage would be negatively affected by increased soil salinities and a shorter period of inundation of its hydrological connection to Río de la Plata were interrupted. You did not consider channelization of the river at that time.

Plan E, recommended in your report, would combine a river channel and levees, and would certainly have greater environmental impact than the previously considered design concepts. We disagree with the statement on Page EIS-11 that direct impacts on wetlands caused by Plan E would be the same as those for Plans C and D. Besides the loss of freshwater riparian vegetation along the present riverbanks, Plan E's levee would cut across the mangrove forest west of the river mouth. We therefore recommend that if Plan E remains the preferred alternative, the levee be moved west as close as possible to Parcelas Mameyal community, which is where the levees are located in Plans A, B, C, and D.

The indirect effects of channelization on the mangroves near the river's mouth have not been addressed in the report. Channelization would prevent surface flows of fresh water to the mangroves except in the greatest floods, increase wetland soil salinity, and lower the seasonally high water table. Flood water velocity would accelerate flow past the mangroves, causing reductions in the period of inundation, input of nutrients, and flushing of mangrove-derived organic matter out to sea. The habitat value of this wetland would be greatly reduced.

Table 9 on Page 27-A shows that essentially equivalent economic benefits and benefit/cost ratios are expected for Plan E and Plan F. However, we find that Plan F would have significantly less long-term impact on the mangroves at the river mouth, since the channel would not be modified. We therefore recommend Plan F (with the levee constructed closer to the edge of Parcelas Mameyal) as providing, consistent with environmental quality concerns, maximal economic benefits.

No evidence is presented to substantiate the statement on Page 28 that although Río Cocal would no longer receive water from Río La Plata, "...the mangroves and lagoon of this area would continue to receive enough water and nutrients from groundwater and surface runoff from the Río Cocal catchment area." Our February 25, 1986, letter regarding this subject stated that groundwater appears to be important in maintaining fresh water input to the marshes and mangroves in the Sabana Seca area, but we are unable to quantify its importance relative to surface flows from Río de la Plata. We recommended that the Corps incorporate features in the project's design to retain flow between the rivers, but this has not been included in your Survey Report. A control structure to allow limited water flow through culverts at Highway 165 would be relatively low in cost and would be a justifiable mitigation feature to avoid adverse impacts on the Río Cocal and Sabana Seca wetlands.

In summary, we recommend that a slightly modified version of Plan F be adopted as the preferred alternative, with the levee at Parcelas Mameyal moved to the western edge of the mangroves. Provisions for water flow to Río Cocal should be incorporated in the project's plans. Thank you for the opportunity to comment.

Sincerely,

Robert T. Pace

Robert T. Pace
Acting Field Supervisor

cc: ✓COE, Jacksonville
AWE, Atlanta

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
26 FEDERAL PLAZA
NEW YORK NEW YORK 10278

FEB 09 1987

A. J. Salem, Chief
Planning Division
Department of the Army
Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Class EO-2

Dear Mr. Salem:

The Environmental Protection Agency (EPA) has reviewed the feasibility study/draft environmental impact statement (FS/DEIS) for the Rio de la Plata Flood Control Project, located in the Toa Baja - Dorado area of Puerto Rico. This review was conducted in accordance with Section 309 of the Clean Air Act, as amended (42 U.S.C. 7609, P.L. 91-604 12(a) 84 stat. 1709).

In addition to the no-action alternative, the FS/DEIS proposes six plans to provide flood control in the project area: Plan E (the preferred plan) involves a combination of extensive channelization and levees; Plan F is similiar to Plan E but would not involve channelization; Plan A involves using ring levees to protect all the towns in the project area except Levittown, and partially channelizing the existing river for 1.23 kilometers; Plan B is similiar to Plan A but would relocate the town of Toa Baja and the community of Toaville; Plan C involves construction of levees along Highway 165 (east bank of river) and relocation of the Town of Toa Baja; Plan D is similiar to Plan C, however this plan would also include construction of ring levees. Based on our review of the draft EIS, we offer the following comments for your consideration.

The analyses presented in the DEIS are not adequate to determine all of the environmental impacts of the proposed project. The extensive channelization proposed in the preferred alternative would increase stream velocities, and result in additional scouring of the stream bed, which would increase turbidity. In addition, elimination of the curves in the river by channelization would not only remove a significant amount of lotic habitat, but would also remove the slow velocity areas of the stream, which serve to reduce suspended sediment levels and lower tubidity. Reducing the length of the river and increasing stream velocity would also decrease the amount of surface water recharge to groundwater, and impact the location of the salt wedge in the stream and in the groundwater. These impacts have not been adequately considered in the DEIS. The DEIS should also discuss in greater detail the method of disposal for the dredged sediment produced by channelization, whether any sediment analyses have been done to determine if contaminants are present, and whether the river segments that will be isolated by the channelization would be backfilled.

Construction of levees will obstruct the flow of water from the Rio de La Plata to the Rio Cocal, causing impacts to the water balance of the area. Accordingly, the DEIS should provide detailed analyses of the impacts on the Rio Cocal, the Rio Cocal mangroves, and the Cienaga de San Pedro. Measures to mitigate these impacts should include a flow structure built into the levee to allow continued flow to the Rio Cocal but still control flood waters. The DEIS should also identify the secondary environmental impacts (particularly enchanced development opportunities) that would result from measures that protect the western floodplain of the Rio de la Plata. Among these development related impacts are these to the area's wastewater treatment facilities, drinking water, and wetlands.

EPA believes the preferred alternative, with its extensive channelization and levees, would produce the most significant environmental impacts among the six alternatives presented. Conversely, we believe that Plan D (which provides selective flood protection with ring levees and minimal channelization) would produce the least impacts. However, we acknowlege that the relocation of Toa Baja (as proposed in Plan D) is not feasible. Accordingly, we believe, that Plan F, which would achieve the same level of flood protection, at the same cost as the preferred alternative (but without channelization or relocation), should be the preferred alternative.

Based on our review, and in accordance with EPA policy, we have rated this draft EIS as EO-2, indicating we have environmental objections (EO) to the selected alternative, based on impacts to water quality, groundwater, wetlands and secondary impacts, and that additional information (2) regarding the above issues/impacts is requested in the final EIS.

Thank you for the opportunity to comment. If there are any questions, Mr. Robert Hargrove, Chief, Federal Activities Section, may be contacted at (212) 264-5390.

Sincerely yours,

Barbara Pastalove

Barbara Pastalove, Chief
Environmental Impacts Branch

cc: USFWS
NMFS

Federal Emergency Management Agency
Region II 26 Federal Plaza New York, New York 10278

JAN 12 1987

Mr. A. J. Salem, Chief
Planning Division
Department of The Army
Jacksonville District, Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Salem:

This is in reference to the draft of the Rio De La Plata, Puerto Rico Environmental Impact Statement, submitted to this office for review.

The overall draft is found to be in compliance with Executive Orders 11988 and 11990.

In addition, the following observations and/or comments are being made concerning Candidate Plan E and the implementation of certain preventative measures being considered.

The activation of Regulation No. 13, disallowing further development in the area of Rio La Plata Flood Basin (Ref. pg. 14-17 of report) appears to be effective in dealing with additional flood damage to the area. This should be considered for inclusion in the "with and without" project conditions.

Further, the possibility of relocating the urban area of Toa Baja, (Ref. pg. 15 of report) appears to be more feasible than the raising of the buildings; although it is our understanding that older established families might resist this move.

The elevation of these structures is considered impractical due to the stress the structures would under go from such a flood prevention measure.

According to the report, structural stress would be due to construction methods used at the time of original construction. We concur, that this tactic would only weaken the foundation of the raised structures.

Finally, we find Candidate Plan E, the combination of channelization and levees a feasible solution to the flooding problems of the area. This plan would improve flood conditions in the following areas, Hwy 165, PR Hwy 693, Town of Dorado and the town of Toa Alta (Ref. pg. 25-26 of report).

The short term effects of this project have been taken into consideration.

Thank you for allowing us to review this report.

If you have any questions, please contact me at (212) 264-4071.

Sincerely,

Steven B Singer
Steven B. Singer, Chief
Public Assistance & Hazard Mitigation Branch

TRIGO

P.O. BOX 2359, TOA BAJA, PUERTO RICO 00759-2891 • TEL. (809) 794-1300/1301/1304/1065 • CABLE: LITRI • TELEX: 385-2218 •

Febrero 9 de 1987

Sr. José A. Martínez
Jefe Grupo Planificación
Cuerpo de Ingenieros
Ejército de U.S.A.
Oficina Area de San Juan
400 Fernández Juncos
San Juan, P.R. 00901

Estimado Sr. Martínez:

Confirmo nuestra conversación telefónica en el día de hoy mediante la cual usted me informó que el plano sobre la canalización del río de La Plata es uno esclusivamente de viabilidad y no es el plano final de ese proyecto. Me informó usted que el plano final tomaría entre tres a cuatro años para diseñarse y que en el interim se usaba este plano de viabilidad para precisamente determinar aquellas áreas de problemas que se pueden resolver e incluir ya en el plano final.

Como le informé, en el plano de viabilidad aparece el muro de contención alrededor del pueblo de Toa Baja girando hacia el este, pasando casi paralelo al cementerio, por detrás de nuestro complejo industrial que incluye entre otros, una destilería y fábrica de licores al igual que el Correo de los Estados Unidos. El plano de viabilidad designa toda esta propiedad como parte del río La Plata y esto es de enorme preocupación, ya que estamos en pleno desarrollo de la propiedad.

Del plano de viabilidad nos percatamos de una posible estrangulación del río La Plata en el área de Toa Baja y sugerimos estudien la viabilidad de mover el muro de contención que pasa por la ribera oeste del río para ensanchar la ribera del río frente al de Toa Baja. También sugerimos que el muro que circunvala el pueblo de Toa Baja en su parte norte continúe en forma paralela al río hasta llegar a la chimenea de la antigua Central Constancia y que use ese punto de referencia como eje para doblar hacia el este y continuar su ruta vía la carretera 165 hacia el norte. Esta desviación no tendría un cambio significativo a la actual en cuanto al muro se refiere, pero sí protegería no solamente la propiedad nuestra sino además los talleres del Departamento de Saneamiento del Municipio de Toa Baja.

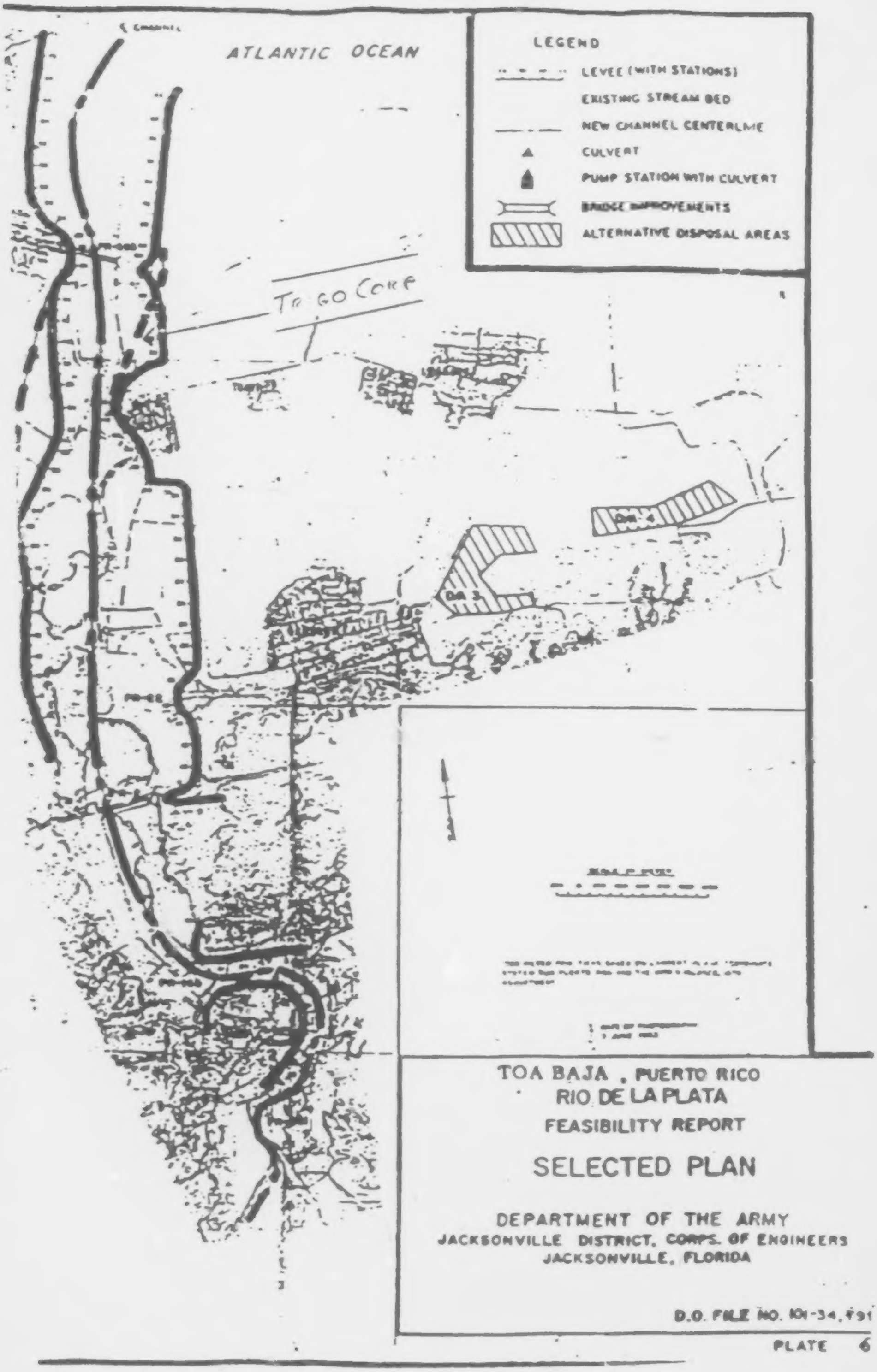
Sin más por el momento me despido,

Muy atentamente,

Juan Salgado
Gerente de Planta

JS/ev

PD. En conjunto le incluímos las sugerencias arriba indicadas al igual que la ubicación de nuestra propiedad.


ATLANTIC OCEAN
LEGEND
LEVEE (WITH STATIONS)
EXISTING STREAM BED
NEW CHANNEL CENTERLINE
CULVERT
PUMP STATION WITH CULVERT
BRIDGE IMPROVEMENTS
ALTERNATIVE DISPOSAL AREAS
To GO Core

TOA BAJA , PUERTO RICO
RIO DE LA PLATA
FEASIBILITY REPORT

SELECTED PLAN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS. OF ENGINEERS
JACKSONVILLE, FLORIDA

D.O. FILE NO. 101-34,791

PLATE 6

Translation of Letter from Manager of Trigo Corporation

9 February 1987

Mr Jose A Martinez
Chief Planning Group
Corps of Engineers
USA Army
San Juan Area Office
400 Fernandez Juncos Ave
San Juan, P.R. 00901

Dear Mr Martinez:

This is to confirm our telephone conversation on which you informed me that the plans for the channelization of Rio La Plata is exclusively a feasibility plan and not the final one for the project. You informed me that the preparation of the final plans would take three or four years and that the feasibility plan is used to determine problem areas that could be resolved and included in the final plan.

As I informed you, the feasibility plan shows the levee around the town of Toa Baja continuining towards the east, almost parallel to the cemetery, behind our industrial complex that includes, among others, a distillery and rum plant and the United States Post Office. The feasibility plan shows all this property as part of Rio La Plata, which is our main concern, since we are in the process of developing this land.

From the feasibility plan we note the possible stranglement of Rio La Plata in the Toa Baja area, and we suggest to study the feasibility of displacing the levee that runs along the west of the river to widen the bank of the river in front of Toa Baja. Also, we suggest that the levee that runs to the north of the town of Toa Baja be relocated to run parallel to the river up to the site of the chimney of old Central Constancia and use this as a reference axis to turn to the east and continue its route along highway 165. This deviation would not represent a significative change with regards to the proposed alignment of the levee, but would protect our property and the workshops of the Department of Sanitation of the Municipio of Toa Baja.

Truly yours,

Juan Salgado
Plant Manager

PD. Enclosed are the suggestions mentioned above and the location of our property.

LIST OF AGENCIES WITH WHICH DRAFT REPORT AND ENVIRONMENTAL IMPACT STATEMENT WAS COORDINATED

RIO LA PLATA

COORDINATION OF DRAFT SURVEY REPORT AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

Hon. Rafael Hernández Colón
Governor of Puerto Rico
La Fortaleza
Box 82
San Juan, Puerto Rico 00901

Hon. Jaime Fuster
Puerto Rico Resident Commissioner
1410 Longworth House Office Bldg.
U. S. House of Representatives
Washington, DC 20515

Hon. Víctor Soto
Mayor
Municipality of Toa Baja
Box 2359
Toa Baja, Puerto Rico 00759

Hon Alfonso López Chaar
Mayor
Municipality of Dorado
Box 588
Dorado, Puerto Rico 00646

Hon. Gilberto Díaz Narváez
Mayor
Municipality of Toa Alta
Box 82
Toa Alta, Puerto Rico 00758

Hon. Justo A. Méndez
Secretary
Deptarment of Natural Resources
Box 5887, Puerta de Tierra
San Juan, Puerto Rico 00906-5887

Hon. Juan Bauzá Salas
Secretary
Department of Agriculture
Commonwealth of Puerto Rico
P. O. Box 10163
Santurce, Puerto Rico 00908

Eng. Patria Custodio
Chairperson
Puerto Rico Planning Board
P. O. Box 41119
San Juan, Puerto Rico 00940-9985

Mr. Santos Rohena Betancourt
President
Environmental Quality Board
Box 11488
Santurce, Puerto Rico 00910-1488

Mr. Roberto Inclán
Director
Bureau of the Budget
Commonwealth of Puerto Rico
Box 3228
San Juan, Puerto Rico 00904

Eng. Germán Landrau Arroyo
Executive Director
Puerto Rico Highway Authority
G. P. O. Box 3909
San Juan, Puerto Rico 00936

Mr. Arturo Valldejulli
Executive Director
PR Aqueduct & Sewer Authority
P. O. Box 7066 Barrio Obrero Station
Santurce, PR 00916

Eng. Leonel Motta
Administrator
Permits & Regulations Adm.
P. O. Box 41179, Minillas Station
Santurce, Puerto Rico 00940

Mr. Heriberto Acevedo Ruiz
Director
Civil Difense
Commonwealth of Puerto Rico
Box 5127, Puerta de Tierra Station
San Juan, PR 00906

Prof. Elías López Sobá
Director
Institute of Puerto Rican Culture
Box 4184
San Juan, Puerto Rico 00905

Arch. Mariano G. Coronas
Director
P. R. Historic Preservation Office
Box 82
San Juan, Puerto Rico 00901

Mr. José E. Morales Ortiz
Acting Administrator
Municipal Services Administration
P. O. Box 70167
San Juan, Puerto Rico 00936

Sociedad de Historia Natural
Estación Experimental
Apartado AQ
Río Piedras, Puerto Rico 00928

President
Ciudadanos Pro Conservación
Recursos Naturales
503 Barbe Street
Santurce, Puerto Rico 00912-3913

President
Fundación Arqueológica e Histórica
de Puerto Rico
Box 9187
Santurce, PR 00908-0187

Dr. Emilio Colón
Area Engineer
U. S. Army Corps of Engineers
San Juan Area Office
400 Fernández Juncos Ave.
San Juan, Puerto Rico 00901

Mr. Pedro Gelabert
Director, Caribbean Area
US Environmental Protection Agency
1413 Fernández Juncos Ave. Stop 20
Santurce, Puerto Rico 00909

Mr. Jeffrey Vonk
Acting Director, Caribbean Area
Soil Conservation Service, USDA
G. P. O. Box 4868
San Juan, Puerto Rico 00936-4868

Mr. Allen Zack
Acting District Chief
Caribbean District
US Geological Survey, WRD
P. O. Box 4424
San Juan, Puerto Rico 00936

Mr. Paul Gertler
Field Supervisor
US Fish and Wildlife Service
P. O. Box 3005, Marina Station
Mayaguez, Puerto Rico 00709-3005

Mr. Juan O. Cruz
Division Administrator
Degetau Federal Bldg., Room 150
Chardón Street
Hato Rey, Puerto Rico 00918-2288

Area Supervisor
National Marine Fisheries Service
Environmental Assessment Branch
3500 Delwood Beach Road
Panama City, Florida 32407-7499

Commander
7th Coast Guard District
51 SW. 1st Avenue
Miami, Florida 33130-1608

Regional Director
US Fish and Wildlife Service
75 Spring Street Southwest
Atlanta, Georgia 30303-3376

Director
Office of Federal Acitivities
EPA, Region II
26 Federal Plaza
New York, New York 10278-0001

Chief
Environmental Impacts Branch
26 Federal Plaza, Room 400
New York, New York 10278-0001

Executive Director
Advisory Council on Hispanic
Preservation
The Old Post Office Building
1100 Pennsylvania Ave., NW #809
Washington, DC 2004-2590

Administrator
Federal Emergency Management Adm.
Room 713, 500 C St., S. W.
Washington, DC 20472

Director
Office of Federal Activities (A-104)
Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
ATTN: EIS Filing Section

TABLE 2
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative (Without Project Conditions)	Ring Levees Plan A	Ring Levees and Reloc. of Toa Baja Plan B	PR Hwy 165 Levees Plan C	PR Hwy 165 Levees and Reloc. of Toa Baja Plan D	Levees and Channel Plan E	Levees Without Channel Plan F
Cultural Resources	37 identified sites will remain subject to flooding and erosion.	Toa Baja levee may adversely affect one site.	Levee around Dorado may adversely affect one site.	No adverse effects. Thirteen (13) identified sites will be protected from future flood damages.	Same as Plan C.	Levee and channel construction will affect 7 sites and may affect an additional 3 sites. Another 7 sites may be indirectly affected by increased erosion. Thirteen (13) identified sites will be protected from flooding.	Levee construction will affect 2 sites. As in Plan E, another 7 sites may be subjected to erosion damage, and 13 will be protected from future flooding.
Flora Wetlands	No impact.	Loss of 5 acres of mangroves. Loss of some grasses and terrestrial vegetation in construction of diversion channel and some riverine vegetation in backfilling eliminated meander.	Same as Plan A, except impacts associated with diversion channel are eliminated.	Same as Plan B.	Same as Plan A.	Same as Plan A. Temporary destruction of vegetation along river edge.	Loss of 7 acres of mangroves.
Fresh Water	No impact.	Same as No-Action Plan.	Same as No-Action Plan.	Will reduce flow of fresh water from Rio de la Plata to Rio Cocal.	Same as Plan C.	Same as Plan C.	Same as Plan C.

TABLE 2 (Continued)
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F
Fauna Avian and Fisheries	No impact.	Construction of the diversion channel and the levees and backfilling the eliminated river curvo would result in the loss of some benthic and terrestrial invertebrates and in temporary disturbance to fauna.	Same as No-Action Plan	Temporary disruption of land fauna due to construction of levees.	Same as Plan C and Plan A.	Same as Plan C. Disruption and partial destruction of aquatic fauna and fisheries because of channel construction and backfilling. The removal of sandbars may induce diversification of aquatic fauna.	Same as Plan C
Federal Threatened and Endangered Species	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Water Quality	Continued erosion, turbidity, and sedimentation.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action plan, but with more turbidity during construction. Reduced flow of fresh water to Rio Cocoal from Rio de la Plata.	Same as Plan C.	Increased erosion and turbidity during construction. Turbidity in the channel could be higher than under existing conditions due to increase in velocities. However, overbank velocities and turbidity during flooding conditions would be considerable lower than under existing conditions.	Same as Plan C.

TABLE 2 (Continued)

COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F
Water Supply							
Surface Water	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Ground Water	Potential for continuous salt-water intrusion. Well-recharged zones will not be impacted.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Same as No-Action Plan.	Increased localized saltwater intrusion along channel. Well-recharge zone is not expected to be adversely impacted.	Same as No-Action Plan.
Land Use	No impact.	Levees will require 263 acres of agricultural land.	Levees will require 225 acres, and the relocation of town will require 168 acres of agricultural lands.	Levees will require 300 acres of agricultural lands. About 5,370 acres of land will be enhanced; only 340 are expected to be urbanized.	Same as Plan C.	Levees will require 367 acres of agricultural lands; 1,700 acres of agricultural lands will remain on the floodway. Over 7,000 acres of land will be enhanced; 2,003 acres of this area is expected to be urbanized. The rest will remain in agriculture.	Same as Plan E.
Noise	No impact.	Temporary noise increase during construction.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.

TABLE 2 (Continued)
COMPARATIVE IMPACTS OF ALTERNATIVES

	No-Action Alternative	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F
Air Quality	No impact.	Main adverse effects during construction.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.	Same as for Plan A.
Solid Waste	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Transportation	Disruption of traffic during floods.	Same as No-Action Plan.	Same as No-Action Plan.	Enhanced opportunity for providing adequate road system.	Same as for Plan C.	Same as for Plan C.	Same as for Plan C.
		55.4	118.3	139.9	75.4		70.9
Economics ($ million) Total Investment Cost	N/A	53.3	116.6	136.8	71.9	66.7	67.1
		5.0	10.5	12.4	6.7		6.3
Annual Cost	N/A	4.8	10.3	12.0	6.4	5.9	6.0
Annual Benefits	N/A	4.6	4.6	8.5	8.6	13.9	13.8
B/C Ratio	N/A	1.0/1.0	0.5/1.0	0.7/1.0	1.3/1.0	2.3/1.0	2.3/1.0
		0.9/1.0	0.4/1.0				2.2/1.0

RIO DE LA PLATE SURVEY INVESTIGATION

APPENDIX G

FINANCIAL PLAN/LCA

I. District Commanders Letter documenting Financial Feasibility

II. Draft Local Cooperation Agreement

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

CESAJ-PD-A (1105) 4 March 1988

MEMORANDUM FOR: Division Commander, South Atlantic Division, Atlanta, Georgia 30335-6801

SUBJECT: Financial Analysis for Rio de la Plata Feasibility Report

1. Reference:

a. EC 1105-2-180, Financial Analysis in Support of Construction Recommendations.

b. CECW-PD undated Memorandum to Resident Member, BERH, Subject: Financial Analysis for Feasibility Reports.

2. During the past few months my Deputy in Puerto Rico, his staff and myself have had several meetings with the Puerto Rico Department of Natural Resources, the local sponsor for the Rio de la Plata Flood Control Study. The purpose of these meetings was to discuss and explain (a) the recommended plan for a flood control project along the Rio de la Plata; and (b) the local responsibilities for contributing with all lands, rights of ways, easements, relocation of bridges, utilities, buildings and structures for the implementation of the recommended plan. In addition the contributing of 5% of the total project first cost (currently estimated to be $2,648,000) during construction was presented. Options for financing the local share and assessing the financial feasibility of the project were also discussed. The local sponsor, the Puerto Rico Department of Natural Resources has expressed their support for the recommended plan and their intent to comply with all requirements as outlined in the feasibility report. Also they have presented their plan to finance the local share in the project using the same method being used for the multi-million ($400 million) multipurpose Portugues-Bucana project currently under construction. Funding will be obtained by annual appropriations from the Commonwealth legislature for the capital improvement program for flood control works managed by the Puerto Rico Department of Natural Resources. These funds will be combined with funds obtained from the selling of Government of Puerto Rico bonds for infrastructure development.

ROBERT L. HERNDON
District Engineer
Commanding

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
PUERTO RICO DEPARTMENT OF NATURAL RESOURCES
FOR CONSTRUCTION OF THE
RIO DE LA PLATA FLOOD CONTROL PROJECT

THIS AGREEMENT, entered into this _____ day of ________, 1987, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), and the Puerto Rico Department of Natural Resources (hereinafter referred to as "(the local sponsor)"), acting by and through ____________________,

WITNESSETH, THAT:

WHEREAS, the Rio de La Plata Flood Control Project was authorized by (cite authority); and,

WHEREAS, the Water Resources Development Act of 1986, Public Law 99-662, specifies the cost-sharing requirements applicable to the Project; and

(other WHEREAS clauses as needed); and,

WHEREAS, the Department of Natural Resources has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in project cost-sharing and financing in accordance with the terms of this Agreement;

NOW THEREFORE, the parties agree as follows:

ARTICLE 1 - DEFINITIONS

For purposes of this Agreement:

1. The term "project" shall mean channel improvement and levees along the Rio de la Plata as described in House Document No. ______

2. The term "total project costs" shall mean all costs incurred by the local sponsor and the Government directly related to construction of the project. Such costs shall include, but not necessarily be limited to, actual construction costs, costs of applicable engineering and design, continuing planning and engineering costs incurred after October 1, 1985, supervision and administration costs, costs of project construction contract dispute settlements or awards, and the value of lands, easements, rights-of-way, relocations, and dredged material disposal areas provided for the project by the local sponsor, but shall not include any costs for betterments or operation and maintenance.

3. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the project by the Contracting Officer.

4. The term "Contracting Officer" shall mean the Commander of the U.S. Army Engineer District, Jacksonville, or his designee.

5. The term "highway" shall mean any highway, thoroughfare, roadway, street or other public road or way.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the local sponsor and appropriated by the Congress, shall expeditiously construct the project (including alterations or relocations of railroad bridges), and approaches, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The local sponsor shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The local sponsor shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bids. The local sponsor also shall be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the views of the sponsor, but award of the contracts and performance of the work thereunder shall be exclusively within the control of the Government.

b. When the Government determines that the project, or functional element thereof, is complete, the Government shall turn the project or element over to the local sponsor, which shall accept the project or element and be solely responsible for operating, maintaining, replacing, and rehabilitating the project or element in accordance with Article VIII hereof.

c. As further specified in Article VI hereof, the local sponsor shall provide, during the period of construction, a cash contribution of 5 percent of total project costs.

d. As further specified in Article III hereof, the local sponsor shall provide all lands, easements, rights-of-way, and dredged material disposal areas, and perform all relocations and alterations of buildings, utilities, highways, railroads, bridges (other than railroad bridges), and approaches sewers, and related and special facilities determined by the Government to be necessary for construction of the project.

e. If the value of the contributions provided under paragraphs c. and d. of this Article represents less than 25 percent to total project costs, the local sponsor shall provide during the period of construction an additional cash contribution in the amount necessary to make its total contribution equal to 25 percent of total project costs.

f. No less than once each year the local sponsor shall inform affected interests of the limitations of the protection afforded by the project.

g. The local sponsor shall publicize floodplain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.)

ARTICLE III - LANDS, FACILITIES, AND RELOCATION ASSISTANCE

a. Prior to the advertisement of any construction contract, the local sponsor shall furnish to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for construction of the project, and shall furnish to the Government evidence supporting the local sponsor's legal authority to grant rights-of-entry to such lands.

b. The local sponsor shall provide or pay to the Government the full cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the project.

c. Upon notification from the Government, the local sponsor shall accomplish or arrange for accomplishment all alterations and relocations of buildings, highways, railroads, bridges (other than railroad bridges) and approaches, storm drains, utilities, cemeteries, and other facilities, structures, and improvements determined by the Government to be necessary for construction of the project.

d. The local sponsor shall comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved January 2, 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be included in total project costs and credited toward the local sponsor's share of total project costs will be determined in accordance with the following procedures:

1. If the lands, easements, or rights-of-way are owned by the sponsor as of the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the Project. The fair market value shall be determined by an appraisal, to be obtained by the sponsor, which has been prepared by an independent and qualified appraiser who is acceptable to both the sponsor and the Government. The appraisal shall be reviewed and approved by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the sponsor after the date this Agreement is signed, the credit shall be the fair market value of the interest at the time such interest is made available to the Government for construction of the project. The fair market value shall be determined as specified in subparagraph 1. above. If the sponsor pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the sponsor has secured prior written approval from the Government of its offer to purchase such interest.

3. If the sponsor acquires more lands, easements, or rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in total project costs and credited to the sponsor's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which occur within a one-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior Government approval.

5. For lands, easements, or rights-of-way acquired by the local sponsor within a five-year period preceding the date this agreement is signed, or any time after this agreement is signed, credits provided under this paragraph will also include the actual incidental costs of acquiring the interest, e.g. closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for any relocation assistance provided in accordance with the obligations under this Agreement.

b. The costs of relocations or modifications of utilities or facilities that will be included in total project costs and credited towards the sponsor's share to total project costs shall be that portion of the actual costs incurred by the sponsor as set forth below.

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the Commonwealth of Puerto Rico would use in constructing a new bridge or highway under similar conditions of geography and traffic loads.

2. Utilities and Facilities (including Railroads): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any relocation or alteration if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in total project costs.

ARTICLE V - ABILITY TO PAY NON-FEDERAL SHARE

The project (does)(does not) qualify for a revision to the non-Federal cost share for flood control based on estimated flood control benefits and costs and on application of guidelines published as Flood Control Study Sharing Requirements under the ability to pay provisions; Interim Final Rule (Volume 52, Federal Register pages 35872-35892, 1987 to be codified at (33 CFR, Sections 241.1 - .6)) implementing Section 103(m) of the Water Resources Development Act of 1986. This revision results in a reduction of the non-Federal cost share responsibility is ____ percent. Not applicable at this time, however, it (may be applicable at the time of authorization. Therefore this article has been included).

ARTICLE VI - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the local sponsor and the Government during the term of construction, the local sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the project.

b. The representatives appointed above shall meet as necessary during the term of project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to the project, but the Contracting Officer, having ultimate responsibility for construction of the project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE VII - METHOD OF PAYMENT

a. The local sponsor shall provide, over the term of construction, the amounts required under Article II.c. and II.e. of this Agreement. Total project costs are presently estimated to be $52,965,000. In order to meet its share, the local sponsor must provide a total cash contribution presently estimated to be $2,648,000.
(IF CONSTRUCTION OF THE PROJECT WILL EXTEND TO MORE THAN ONE YEAR, USE THE FOLLOWING UNLESS THE SPONSOR WISHES TO MAKE ITS CONTRIBUTION IN FULL AT THE OUTSET:

b. The local sponsor shall provide its required cash contribution in proportion to the rate of Federal expenditures over the term of the construction period in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the local sponsor by ____________ of each year of the estimated funds that will be required from the sponsor to meets its share of project costs for the corresponding Government fiscal year.

2. (Between 30 and 60) days prior to the award of the first construction contract, the Government shall notify the local sponsor of its share of project costs, including costs attributable to the project incurred prior to the initiation of construction, for the first fiscal year of construction. Within (one-half of 30-60, depending on the period selected in line one) days thereafter, the local sponsor shall (select one: provide the requisite amount to the Government in cash by delivering a check payable to "FAO, USAED, Mobile District" to the Contracting Officer, or verify to the satisfaction of the Government that it has deposited the requisite amount in an escrow account acceptable to the Government, with interest accruing to the sponsor, or present to the Government in an amount sufficient to meet its obligation).

3. For the second and subsequent fiscal years of project construction, the Government shall, 60 days prior to the beginning of the fiscal year, notify the local sponsor of its share of project costs for the fiscal year. No later than 30 days prior to the beginning of the fiscal year, the local sponsor shall make the necessary funds available to the Government through the funding mechanism specified above. As construction of the project proceeds, the Government may adjust the amounts required to be provided under this paragraph to reflect actual project costs.

4. If at any time during the period of construction the Government determines that additional funds will be needed from the local sponsor to meet its required share of project costs, the Government shall so notify the sponsor and the sponsor, within (30-60) days from receipt of notice shall make the necessary funds available through the funding mechanism specified above.)

c. The Government will draw on the funds account provided by the local sponsor such sums as it deems necessary to cover contractual and in-house fiscal obligations attributable to the project as they are incurred, as well as project costs incurred by the Government prior to the initiation of construction.

d. Upon completion of the project and resolution of all relevant contract claims and appeals, the Government shall compute the total project costs and tender to the local sponsor a final accounting of its share of project costs. In the event the total contribution by the local sponsor is less than its minimum required share of project costs at the time of the final accounting, the local sponsor shall, within 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever is required to meet its minimum required share of project costs. In the event the local sponsor has made cash contributions in excess of 5 percent of total project costs which result in the local sponsor's having provided more than its required share of project costs, the Government shall within 90 days of the final accounting, subject to the availability of appropriations, return said excess to the sponsor; however, the sponsor shall not be entitled to any refund of the 5 percent cash contribution required pursuant to Article II.c. hereof. If the sponsor's total contribution under this Agreement (including lands, easements, rights-of-way, relocations, and dredged material disposal areas provided by the sponsor) exceeds 50 percent of total project costs, the Government shall, subject to the availability of appropriations, refund the excess to the sponsor within 90 days of the final accounting.

ARTICLE VIII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE IX - OPERATION, MAINTENANCE, AND REHABILITATION

a. After it is turned over by the Government, the local sponsor shall operate, maintain, replace, and rehabilitate the project, or functional element thereof, in accordance with regulations or directions prescribed by the Government.

b. The local sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the project. If an inspection shows that the local sponsor for any reason if failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the local sponsor. If the local sponsor persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the local sponsor owns or controls for access to the project for the purpose of completing, operating, repairing, maintaining, replacing, or rehabilitating the project. No completion, operation, repair, maintenance, replacement, or rehabilitation by the Government shall operate to relieve the local sponsor of responsibility to meets its obligation as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE X - RELEASE OF CLAIMS

The local sponsor shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE XI - MAINTENANCE OF RECORDS

The Government and the local sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the local sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XII - FEDERAL AND COMMONWEALTH LAWS

In acting under its rights and obligations hereunder, the local sponsor agrees to comply with all applicable Federal and Commonwealth laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XIII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIV - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XV - COVENANT AGAINST CONTINGENT FEES

The local sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the local sponsor for the purpose of securing business. For breach or violations of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XVI - TERMINATION OR SUSPENSION

a. If at any time the local sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the project until the local sponsor is no longer in arrears, unless the Secretary determines that continuation of work on the project is in the interest of the United States. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations in amounts sufficient to meet project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the local sponsor. After 60 days either party may elect without penalty to terminate this Agreement or to suspend performance thereunder, and the parties shall conclude their activities relating to the project and proceed to a final accounting in accordance with Article VI.

ARTICLE XVII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been dully given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage-prepaid), registered, or certified mail, as follows:

If to the local sponsor:
Department of Natural Resources
Munoz Rivera Avenue
Stop 3
San Juan, Puerto Rico 00900

If to the Government:
U.S. Army Corps of Engineers
Jacksonville District
Post Office Box 4970
Jacksonville, Florida 32232-0019

b. A party may change the address to which such communications are to be directed by giving written notice to the other in the manner provided in this section.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or on the third business day after it is mailed, as the case may be.

ARTICLE XVIII _ CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

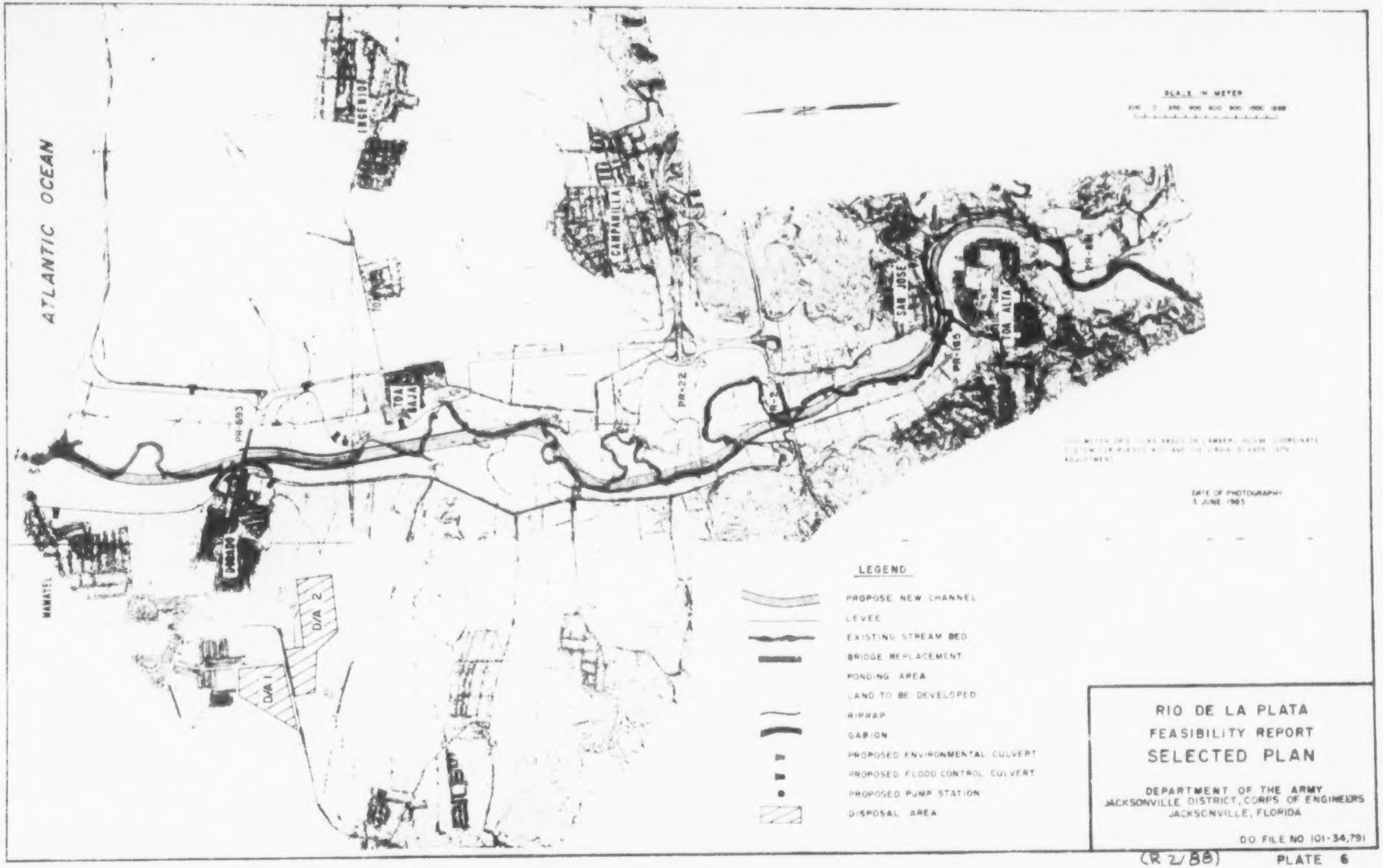
THE DEPARTMENT OF THE ARMY	THE LOCAL SPONSOR
BY: ______________________	BY: ______________________
ROBERT W. PAGE Assistant Secretary of the Army (Civil Works)	
DATE: ______________________	DATE: ______________________

CERTIFICATE OF AUTHORITY

I, ______________________________, do hereby certify that I am the Attorney, General of the Government of the U.S. Virgin Island in the Commonwealth of Puerto Rico and that The Department of Natural Resources is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Commonwealth of Puerto Rico in connection with the construction of a Flood Control Project for Rio de la Plata and to pay damages, if necessary, in the event of the failure to perform in accordance with Section 221 of Public law 91-611 and that the person(s) who have executed the contract on behalf of the Department of Natural Resources have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certificate this _____ day of ________________ 198__.

____
Attorney


ATLANTIC OCEAN
INGENIO
CAMPANILLA
SAN JOSE
TOA ALTA
TOA BAJA
DORADO
MAMAYEL
PR-693
PR-22
PR-2
PR-165
PR-861
D/A 1
D/A 2
SCALE IN METER
200 0 200 400 600 800 1000 1200
DATE OF PHOTOGRAPHY
3 JUNE 1983
LEGEND
PROPOSE NEW CHANNEL
LEVEE
EXISTING STREAM BED
BRIDGE REPLACEMENT
PONDING AREA
LAND TO BE DEVELOPED
RIPRAP
GABION
PROPOSED ENVIRONMENTAL CULVERT
PROPOSED FLOOD CONTROL CULVERT
PROPOSED PUMP STATION
DISPOSAL AREA

RIO DE LA PLATA
FEASIBILITY REPORT
SELECTED PLAN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

DO FILE NO 101-34,791

(R 2/88) PLATE 6